United States
Department of
Agriculture

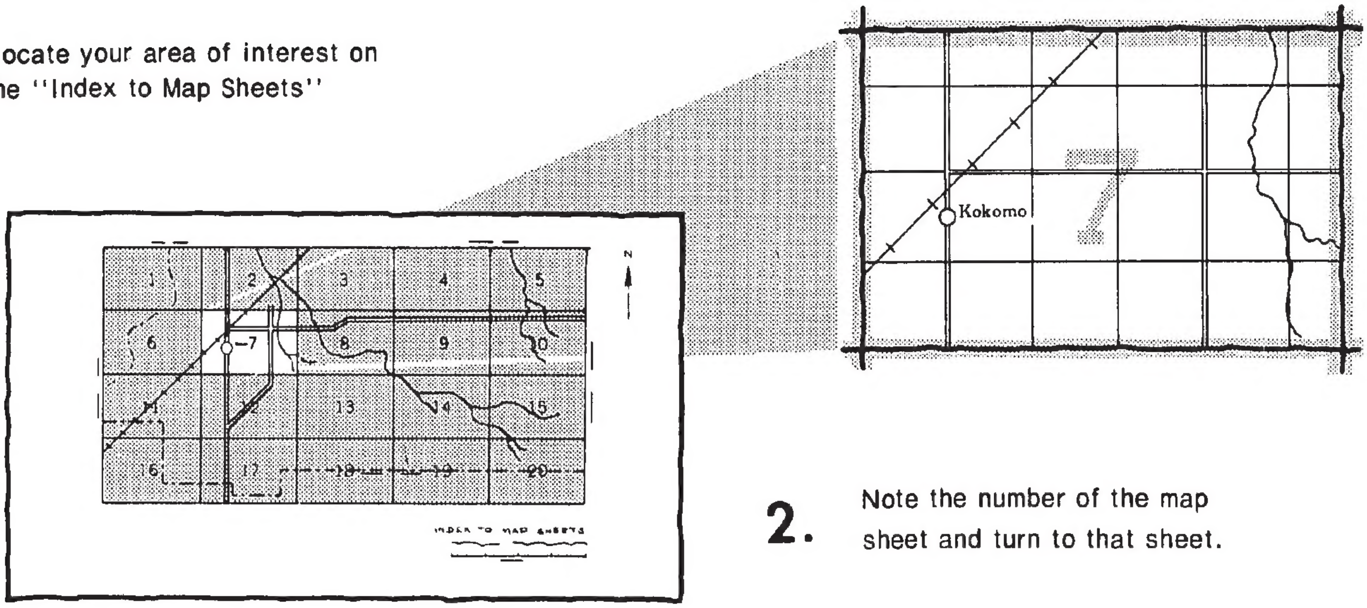
Soil
Conservation
Service

In cooperation with
Kansas Agricultural
Experiment Station

Soil Survey of Cherokee County, Kansas

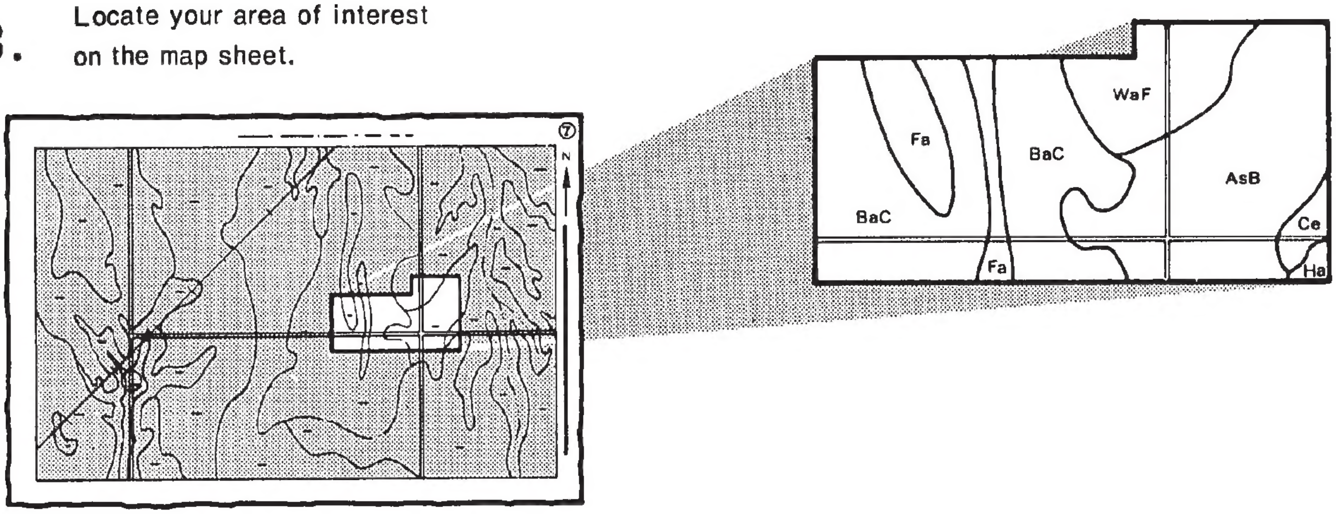
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"

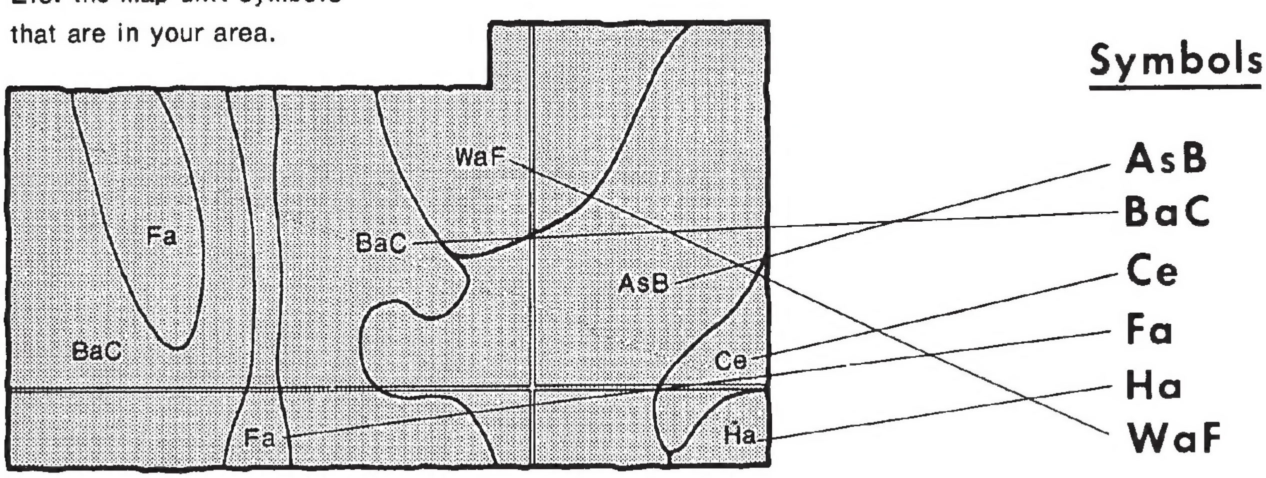


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.

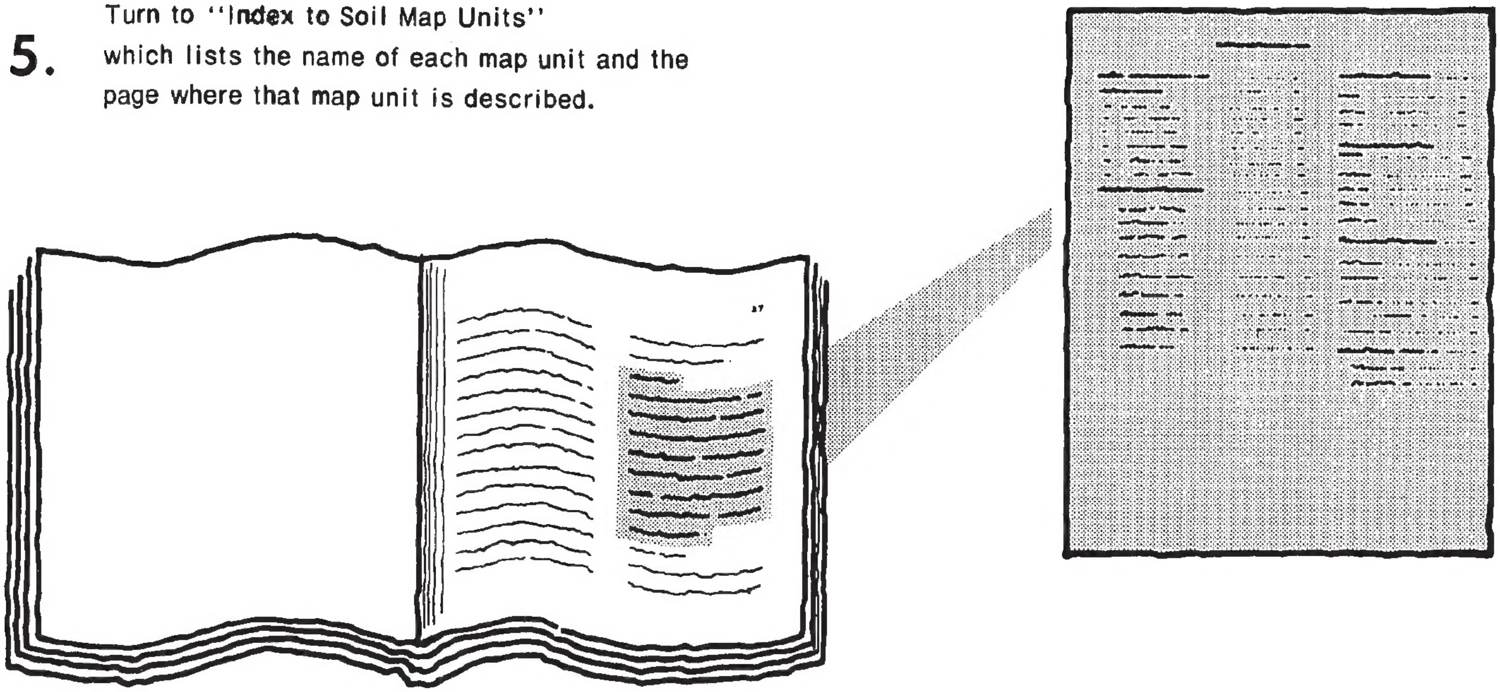


4. List the map unit symbols that are in your area.

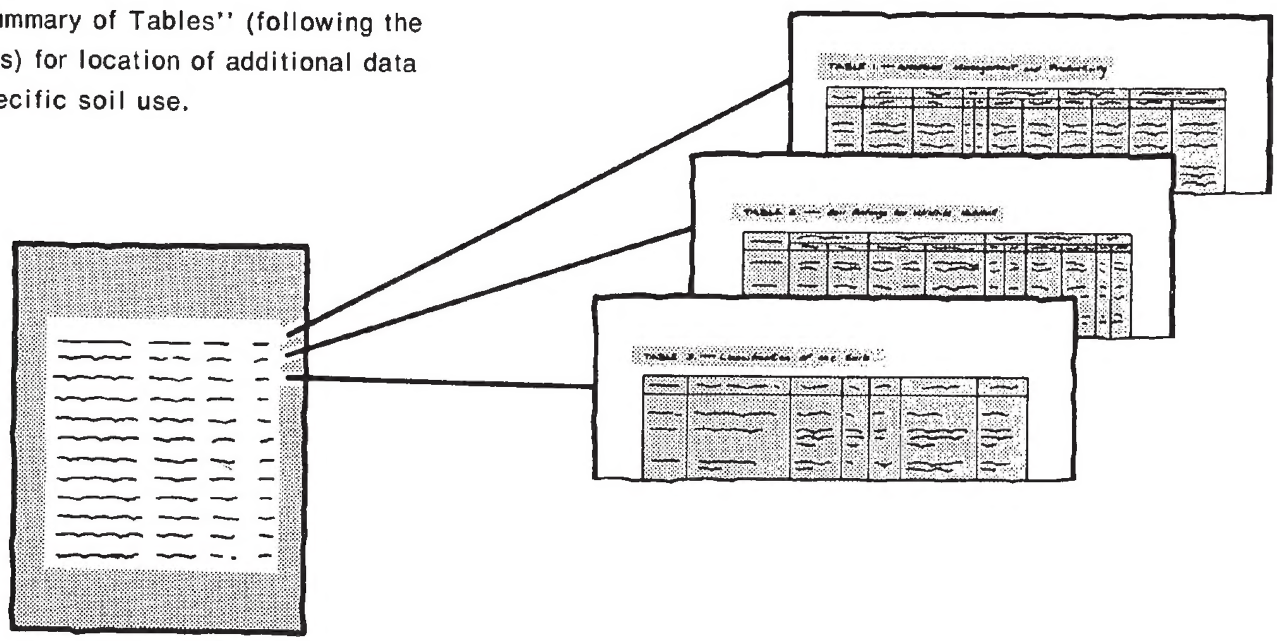


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed during the period 1980-83. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This survey was made cooperatively by the Soil Conservation Service and the Kansas Agricultural Experiment Station. It is part of the technical assistance furnished to the Cherokee County Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Crop residue on the surface of Parsons silt loam, 0 to 2 percent slopes. Returning crop residue to the soil helps to maintain tilth. The hedgerow of osageorange provides habitat for wildlife.

Contents

Soil Series

Issued August 1985

Index to Map Units

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Cherokee County, Kansas. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

John W. Tippie

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State Conservationist
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Soil Survey of
Cherokee County, Kansas

By Edward L. Fleming, Howard V. Cambell, and H. Dan Owens,
Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
the Kansas Agricultural Experiment Station

CHEROKEE COUNTY is in the southeast corner of Kansas (fig. 1). It has a total area of 378,675 acres, or 592 square miles. The population was 22,631 in 1981. Columbus, the county seat, has a population of 3,351. Baxter Springs has a population of 4,724, and Galena has one of 3,442. The county was organized in 1866.

Farming and related services are the most important enterprises in the county. Small industries also are important. The climate favors cash grain and livestock farming. The main crops are wheat, grain sorghum, soybeans, and tall fescue.

This survey updates the soil survey of Cherokee County published in 1914 (*6*). It provides additional information and larger maps, which show the soils in greater detail.

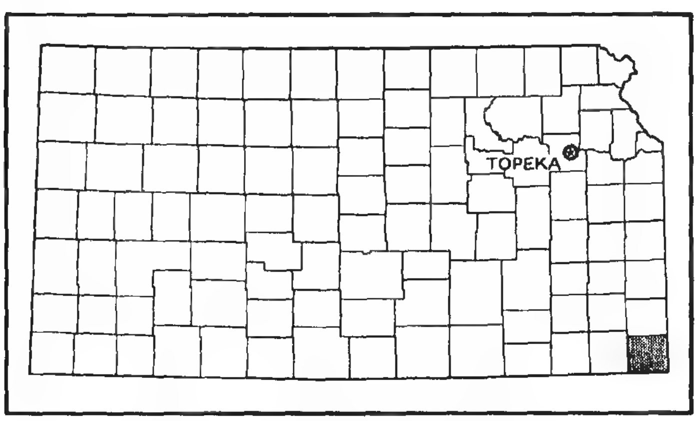

Figure 1.—Location of Cherokee County in Kansas.

General Nature of the County

This section gives general information concerning the county. It describes climate; physiography, drainage, and relief; water supply; and natural resources.

Climate

Prepared by Merle J. Brown, climatologist, Kansas Agricultural Experiment Station, Manhattan, Kansas.

The climate of Cherokee County is typical continental, as can be expected of a location in the interior of a large landmass in the middle latitudes. This climate is characterized by large daily and annual variations in temperature. Winters are cold because of frequent outbreaks of polar air. The cold temperatures prevail from December to February. Warm summer temperatures last for about 6 months every year. They provide a long growing season for the crops commonly grown in the county. Spring and fall are relatively short.

Cherokee County is in the path of a fairly dependable current of moisture-laden air from the Gulf of Mexico. Precipitation is heaviest late in spring and early in summer. Much of it falls during late-evening or nighttime thunderstorms. Although the total precipitation generally is adequate for any crop, its distribution may cause problems in some years. Prolonged dry periods of several weeks are not uncommon during the growing season. A surplus of precipitation often results in muddy fields, which delay planting and harvesting.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Columbus in the period 1941 to 1970. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 37.1 degrees F, and the average daily minimum temperature is 26.6 degrees. The lowest temperature on record, which occurred at Columbus on February 13, 1905, is -28 degrees. In summer the average temperature is 77.7 degrees, and the average daily maximum temperature is 89.3 degrees. The highest recorded temperature, which occurred at Columbus on July 14, 1954, is 117 degrees.

The total annual precipitation is 40.52 inches. Of this, 27.91 inches, or 69 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 22.68 inches. The heaviest 1-day rainfall during the period of record was 8.4 inches at Columbus on June 22, 1948.

Tornadoes and severe thunderstorms strike occasionally. These storms are usually local in extent and of short duration, so that the risk of damage is small. Hail falls during the warmer part of the year, but the hailstorms are infrequent and of local extent. They cause less crop damage than the hailstorms in western Kansas.

The average seasonal snowfall is 10.4 inches. The highest seasonal snowfall during the period of record was 34.7 inches. On the average, 11 days of the year have at least 1 inch of snow on the ground, but the snow cover generally does not last for over 7 days in succession.

The sun shines 69 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 11 miles per hour, in March and April.

Physiography, Drainage, and Relief

Most of Cherokee County is in the Cherokee Prairie land resource area. Generally, the upland landscape in this area includes broad flats, broad gently sloping areas, and low hills. A small part of the county generally east of the Spring River is in the Ozark Highland land resource area. The uplands in this area typically are hilly timberland.

The western part of the county is drained by the Neosho River and its tributaries and the eastern part by the Spring River and its tributaries (fig. 2). Both streams flow in a southerly direction. The highest elevation, in the southeastern part of the county, is about 1,000 feet above sea level. The lowest, along the Neosho River in the southwestern part, is about 760 feet.

Water Supply

The water supply in most of Cherokee County varies. A dependable supply of ground water is not available in many parts of the county. In most upland areas, obtaining wells that provide an adequate supply of good-quality water is difficult. Most successful wells are drilled in the alluvial deposits along drainageways. These are generally low-producing wells that do not provide enough water for domestic purposes.

The principal source of water for livestock is surface water impounded by dams on intermitted streams. The smaller streams and the ground water discharged by seeps and springs are sources of water, but they can dry up during prolonged periods of low rainfall.

The water for farm uses is drawn from rural water district supply lines or ponds. The water for the towns is supplied mostly by the larger streams, by lakes, and by deep wells.

Natural Resources

Soil is the most important natural resource in the county. Also important are native range, timber, wild game and fish, and minerals. Coal, lead, zinc, and shale are the most common minerals. Coal and shale are mined for commercial uses.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

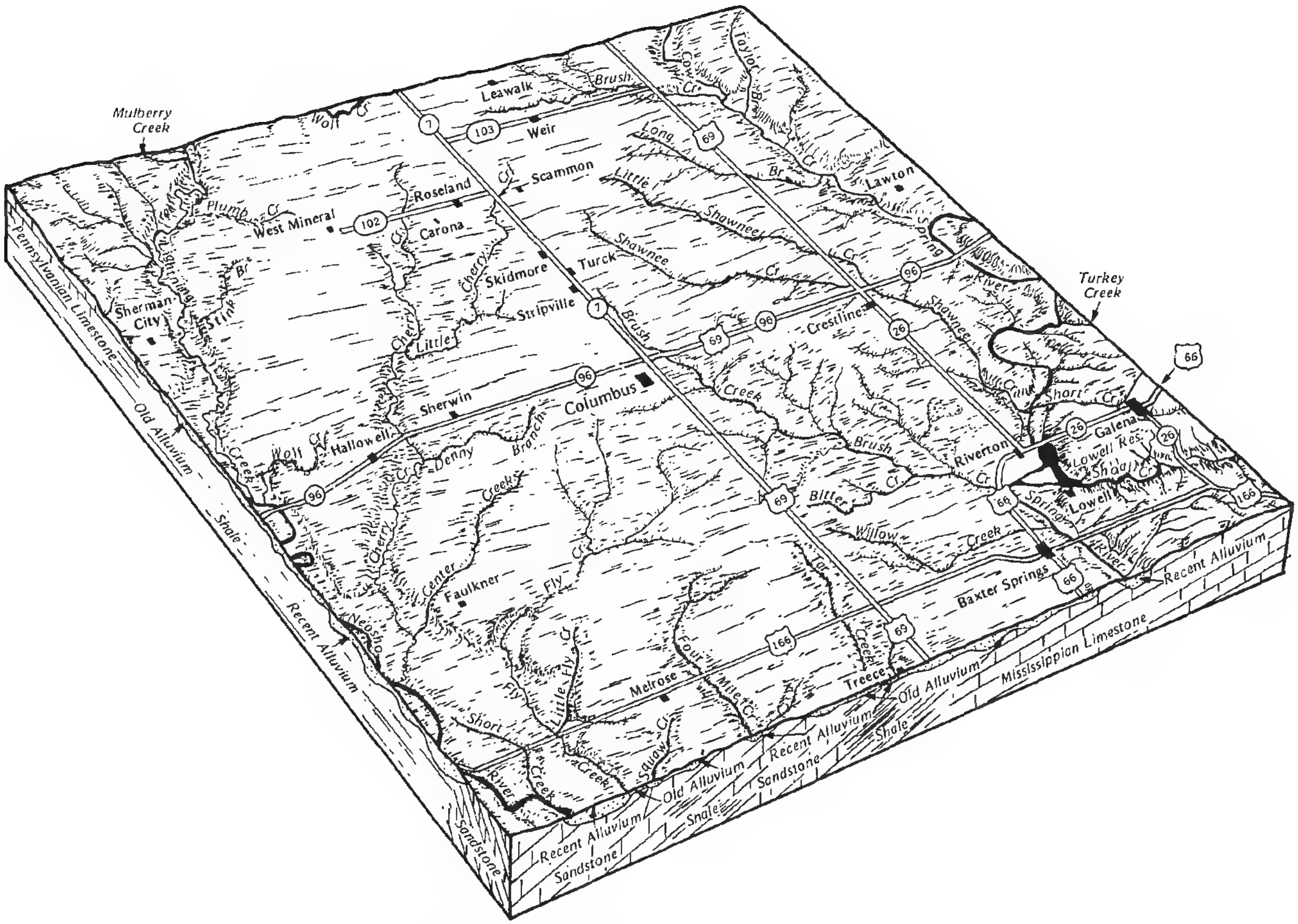

Figure 2.—Drainage and geologic material in Cherokee County.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil

properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The descriptions and names of the soils identified on the general soil map of this county do not fully agree with those of the soils identified on the general soil maps of adjacent counties. Differences result from a better knowledge of soils, modification of series concepts, a higher or lower intensity of mapping, and variations in the extent of the soils in the counties.

Soil Descriptions

1. Parsons-Zaar-Catoosa Association

Deep and moderately deep, nearly level, somewhat poorly drained and well drained, silty and clayey soils; on uplands

This association is on ridgetops, foot slopes, and upland flats that are dissected by drainageways. Slope ranges from 0 to 2 percent.

This association makes up about 7 percent of the county. It is about 40 percent Parsons soils, 30 percent Zaar soils, 20 percent Catoosa soils, and 10 percent minor soils (fig. 3).

The deep, somewhat poorly drained Parsons soils formed in old alluvium on broad flats. Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown, mottled, friable silt loam about 6 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is very dark grayish brown and dark grayish brown, mottled, very firm clay. The lower part is gray, yellowish brown, and yellowish red, very firm silty clay.

The deep, somewhat poorly drained Zaar soils formed in shale residuum on foot slopes. Typically, the surface layer is black silty clay about 8 inches thick. The subsurface layer is black, firm silty clay about 7 inches thick. The subsoil is mottled, very firm silty clay about 37 inches thick. The upper part is black, and the lower part is dark brown. The substratum to a depth of about 60 inches is dark gray and yellowish brown silty clay.

The moderately deep, well drained Catoosa soils formed in material weathered from limestone on ridgetops. Typically, the surface soil is dark brown silt loam about 12 inches thick. The subsoil is dark reddish brown, firm silty clay loam about 16 inches thick. Limestone bedrock is at a depth of about 28 inches.

The minor soils in this association are Eram, Dennis, and Shidler soils. The moderately well drained, moderately sloping Eram soils are on side slopes. The moderately well drained, gently sloping Dennis soils also are on side slopes. The shallow Shidler soils are on ridgetops.

About 60 percent of this association is used for cultivated crops, and 40 percent is pasture or range. Cash grain farming and livestock farming are the main farm enterprises. The principal crops are wheat, grain sorghum, and soybeans. Maintaining tilth and fertility and improving drainage are the main concerns in managing cropland. Maintaining or improving the stand of desirable grasses is the main concern in managing range and pasture.

2. Hepler-Osage Association

Deep, nearly level, somewhat poorly drained and poorly drained, silty and clayey soils; on terraces and flood plains

This association is on bottom land along the major streams in the county. The soils are subject to flooding. Slope ranges from 0 to 2 percent.

This association makes up about 12 percent of the county. It is about 55 percent Hepler soils, 30 percent Osage soils, and 15 percent minor soils.

The somewhat poorly drained Hepler soils formed in silty alluvium on terraces and flood plains. Typically, the

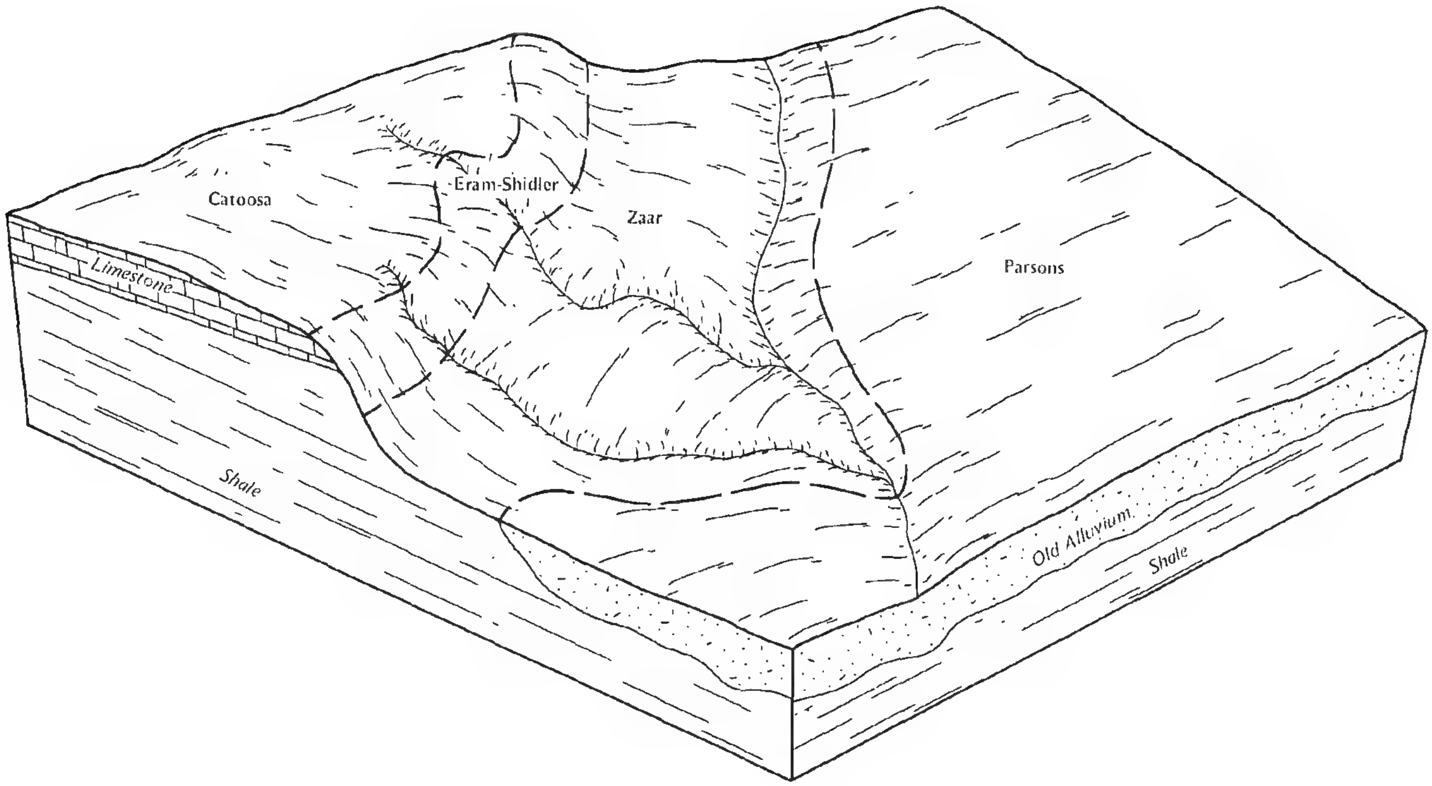

Figure 3.—Typical pattern of soils and underlying material in the Parsons-Zaar-Catoosa association.

surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark brown and brown, friable silt loam about 16 inches thick. It is mottled in the lower part. The subsoil to a depth of more than 60 inches is mottled, firm silty clay loam. The upper part is dark grayish brown, and the lower part is grayish brown.

The poorly drained Osage soils formed in clayey alluvium on flood plains. Typically, the surface layer is black silty clay about 6 inches thick. The subsurface layer is black, very firm silty clay about 11 inches thick. It is mottled in the lower part. The subsoil to a depth of about 60 inches is very dark gray and dark gray, mottled, extremely firm clay.

The minor soils in this association are the somewhat poorly drained Lanton and moderately well drained Verdigris soils. These soils are on flood plains.

Most of this association is used for cultivated crops. A few areas are used as pasture. Hardwood trees grow along the stream channels. General cash grain farming is the main farm enterprise. The main crops are wheat, grain sorghum, and soybeans. The main concerns of management are controlling flooding, maintaining fertility and tilth, and improving drainage.

3. Parsons-Dennis Association

Deep, nearly level and gently sloping, somewhat poorly drained and moderately well drained, silty soils; on uplands

This association is on broad upland flats, ridges, and side slopes that are dissected by drainageways. Slope ranges from 0 to 3 percent.

This association makes up about 40 percent of the county. It is about 46 percent Parsons soils, 35 percent Dennis soils, and 19 percent minor soils (fig. 4).

The somewhat poorly drained Parsons soils formed in old alluvium on flats. They are nearly level. Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown, mottled, friable silt loam about 6 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is very dark grayish brown and dark grayish brown, mottled, very firm clay. The lower part is gray, yellowish brown, and yellowish red, very firm silty clay.

The moderately well drained Dennis soils formed in material weathered from shale on side slopes and low knolls. They are gently sloping. Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is very dark grayish brown,

friable silt loam about 4 inches thick. The subsoil extends to depth of more than 60 inches. The upper part is dark brown, mottled, friable silty clay loam. The next part is dark brown and brown, mottled, firm and very firm silty clay. The lower part is gray and strong brown, mottled, very firm silty clay and firm silty clay loam.

The minor soils in this association are Bates, Hepler, and Kanima soils. The moderately deep, well drained Bates soils are on side slopes and ridgetops. The deep, somewhat poorly drained Hepler soils are on flood plains along drainageways. Kanima soils are in areas that have been strip mined.

Most of this association is used for cultivated crops. The main concerns of management are controlling water erosion and maintaining tilth and fertility. A surface drainage system is needed in some areas of the Parsons soils.

4. Cherokee-Hepler Association

Deep, nearly level, somewhat poorly drained, silty soils; on uplands, terraces, and flood plains

This association is on broad upland flats and ridgetops that are dissected by drainageways. Slope ranges from 0 to 2 percent.

This association makes up about 5 percent of the county. It is about 82 percent Cherokee soils, 12 percent Hepler soils, and 6 percent minor soils.

The Cherokee soils formed in old alluvium on broad upland flats. Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is grayish brown, mottled, friable silt loam about 7 inches thick. The subsoil is mottled, very firm clay about 33 inches thick. The upper part is very dark grayish brown, the next part is dark grayish brown, and the lower part is grayish brown. The substratum to a depth of about 60 inches is grayish brown, mottled silty clay loam.

The Hepler soils formed in silty alluvium on terraces and flood plains. Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark brown and brown, friable silt loam about 16 inches thick. It is mottled in the lower part. The subsoil to a depth of more than 60 inches is mottled, firm silty clay loam. The upper part is dark grayish brown, and the lower part is grayish brown.

The minor soils in this association are Dennis and Parsons soils. The moderately well drained, gently sloping Dennis soils are on side slopes. Parsons soils

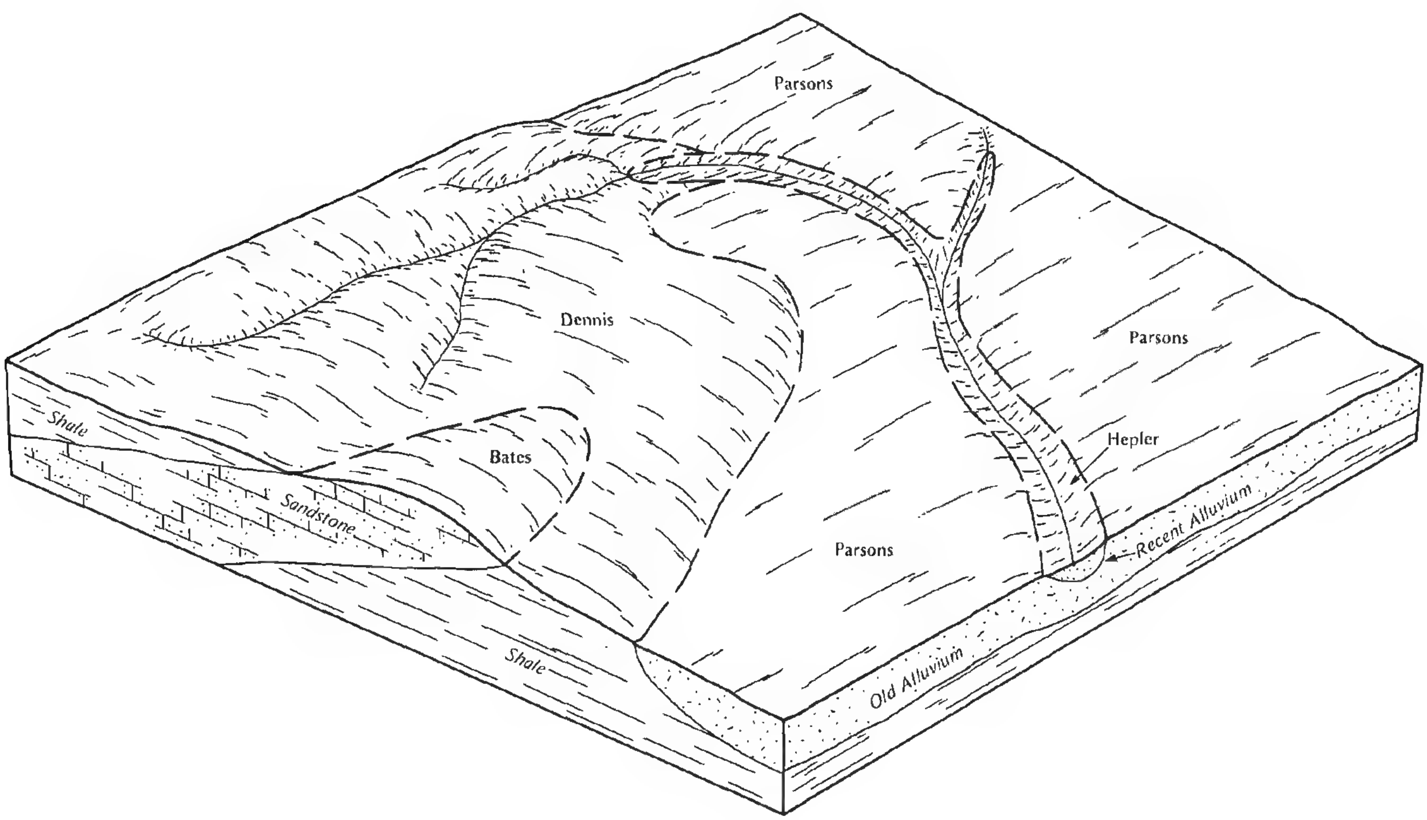

Figure 4.—Typical pattern of soils and underlying material in the Parsons-Dennis association.

have a dark surface layer. They are on broad upland flats.

Most of this association is cultivated. Some areas are used as tame pasture. The main crops are soybeans, wheat, and grain sorghum. The main management needs in cultivated areas are measures that improve drainage and maintain tilth and fertility. Increasing forage production is a concern in managing pasture.

5. Dennis-Bates-Parsons Association

Deep and moderately deep, nearly level to moderately sloping, well drained to somewhat poorly drained, silty and loamy soils; on uplands

This association is on ridges, side slopes, and flats that are dissected by drainageways. Slope ranges from 0 to 6 percent.

This association makes up about 18 percent of the county. It is about 38 percent Dennis soils, 28 percent Bates soils, 25 percent Parsons soils, and 9 percent minor soils (fig. 5).

The deep, moderately well drained Dennis soils formed in material weathered from shale on side slopes. They are gently sloping. Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 4 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is dark brown, mottled, friable silty clay loam. The next part is dark brown and brown, mottled, firm and very firm silty clay. The lower part is gray and strong brown, mottled, very firm silty clay and firm silty clay loam.

The moderately deep, well drained Bates soils formed in material weathered from sandstone and sandy shale on side slopes. They are gently sloping or moderately sloping. Typically, the surface soil is very dark grayish brown loam about 13 inches thick. The subsoil is about 21 inches thick. The upper part is dark brown, mottled, friable loam, and the lower part is dark brown, mottled, firm clay loam. Soft sandstone bedrock is at a depth of about 34 inches.

The deep, somewhat poorly drained Parsons soils formed in old alluvium on broad flats. They are nearly level. Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown, mottled, friable silt loam about 6 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is very dark grayish brown and dark grayish brown, mottled, very firm clay.

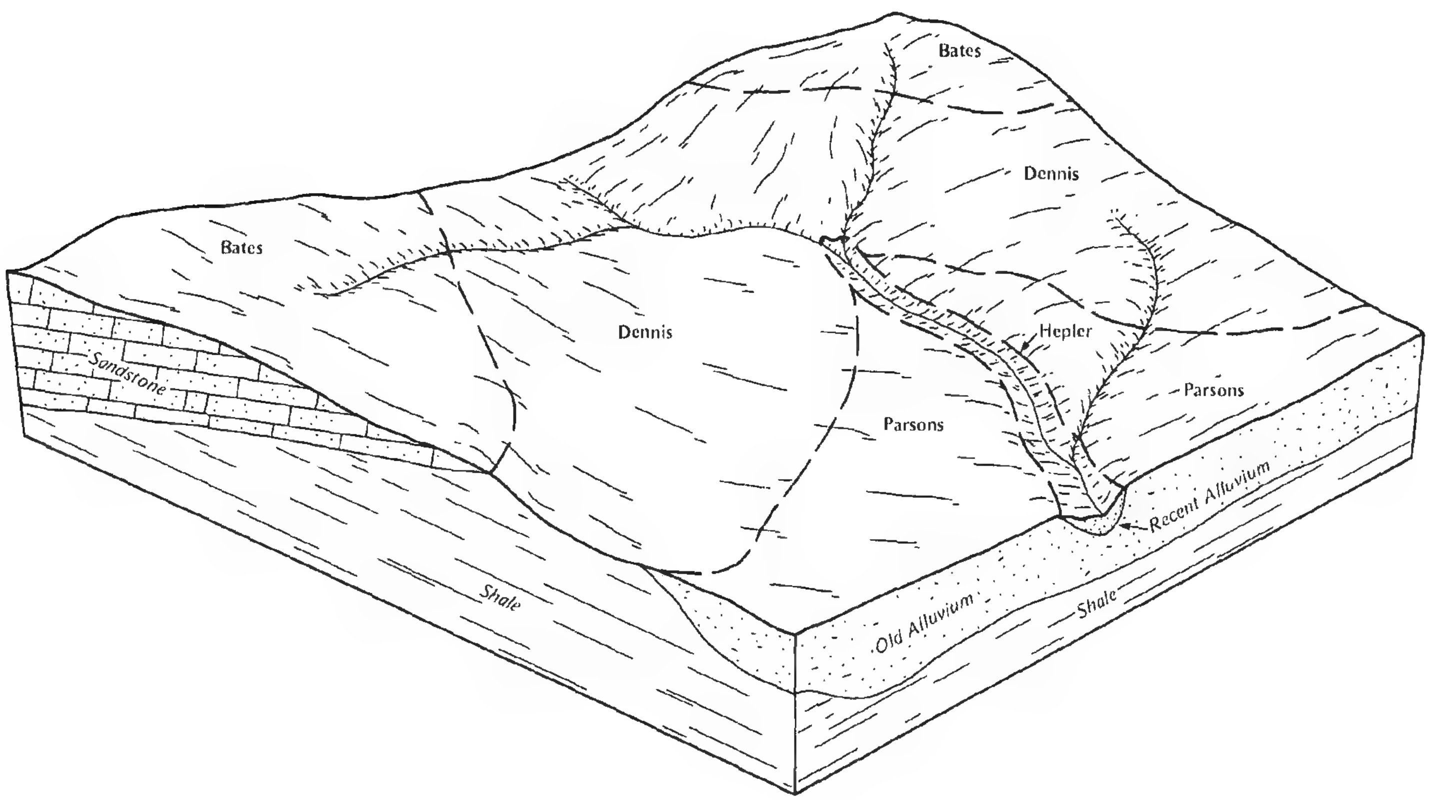

Figure 5.—Typical pattern of soils and underlying material in the Dennis-Bates-Parsons association.

The lower part is gray, yellowish brown, and yellowish red, very firm silty clay.

The minor soils in this association are Collinsville and Hepler soils. The shallow Collinsville soils are on side slopes. The somewhat poorly drained Hepler soils are on low terraces along drainageways.

About 60 percent of this association is cultivated, and 40 percent is pasture or range. Cash grain farming and livestock farming are the main farm enterprises. The principal crops are wheat, grain sorghum, and soybeans. The main management needs are measures that control erosion and maintain or improve tilth and fertility in the cultivated areas and that maintain or increase grass production on pasture or range.

6. Taloka-Dennis Association

Deep, nearly level and gently sloping, somewhat poorly drained and moderately well drained, silty soils; on uplands

This association is on broad upland flats, ridges, and side slopes that are dissected by drainageways. Slope ranges from 0 to 3 percent.

This association makes up about 6 percent of the county. It is about 40 percent Taloka soils, 35 percent Dennis soils, and 25 percent minor soils.

The somewhat poorly drained Taloka soils formed in old alluvium mantled by silty eolian sediments. They are on broad flats and are nearly level. Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown and grayish brown silt loam about 13 inches thick. It is mottled in the lower part. The subsoil extends to a depth of more than 60 inches. The upper part is dark grayish brown, mottled, very firm silty clay. The next part is multicolored, very firm silty clay. The lower part is dark grayish brown, mottled, firm silty clay loam.

The moderately well drained Dennis soils formed in material weathered from shale on side slopes and low knolls. They are gently sloping. Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 4 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is dark brown, mottled, friable silty clay loam. The next part is dark brown and brown, mottled, firm and very firm silty clay. The lower part is gray and strong brown, mottled, very firm silty clay and firm silty clay loam.

Minor in this association are Bates soils and mine dumps. The gently sloping and moderately sloping Bates soils are on side slopes. They are moderately deep over sandstone. The mine dumps are in scattered areas throughout the association. They are piles of chat and rock from mines.

Most of this association is cultivated. Some areas are used as tame pasture. The main crops are soybeans, wheat, and grain sorghum. Controlling erosion and maintaining fertility are the main concerns in managing cropland. A surface drainage system is needed in some areas of the Taloka soils.

7. Clarksville-Nixa-Tonti Association

Deep, gently sloping to moderately steep, somewhat excessively drained and moderately well drained, cherty and silty soils; on uplands

This association is on ridgetops and side slopes that are dissected by many drainageways. Slope ranges from 2 to 30 percent.

This association makes up about 6 percent of the county. It is about 30 percent Clarksville soils, 25 percent Nixa soils, 20 percent Tonti soils, and 25 percent minor soils (fig. 6).

The somewhat excessively drained Clarksville soils formed in material weathered from cherty limestone on side slopes. They are strongly sloping and moderately steep. Typically, the surface layer is dark grayish brown very cherty silt loam about 4 inches thick. The subsurface layer is brown, friable very cherty silt loam about 19 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is dark brown, firm very cherty silty clay loam. The lower part is yellowish red, firm extremely cherty silty clay loam.

The moderately well drained Nixa soils formed in material weathered from cherty limestone on side slopes. They are gently sloping and moderately sloping. Typically, the surface layer is dark grayish brown cherty silt loam about 5 inches thick. The subsurface layer is brown, friable very cherty silt loam about 8 inches thick. The upper part of the subsoil also is brown, friable very cherty silt loam. The next part is a fragipan of yellowish brown, mottled, firm extremely cherty silt loam. The lower part to a depth of about 60 inches is multicolored, firm extremely cherty silty clay loam.

The moderately well drained Tonti soils formed in material weathered from cherty limestone on ridgetops and side slopes. They are moderately sloping. Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of more than 60 inches. It is, in sequence downward, yellowish brown, friable cherty silt loam; yellowish brown, mottled, firm cherty silty clay loam; a fragipan of strong brown and light gray, firm very cherty silty clay loam; and red and reddish yellow, firm extremely cherty silty clay loam.

The minor soils in this association are Gerald, Secesh, and Waben soils. The somewhat poorly drained, nearly level Gerald soils are on ridgetops. The well drained, nearly level Secesh soils are on stream terraces and are subject to rare flooding. The well drained Waben soils are on terraces and the lower side slopes.

About 50 percent of this association is used for trees and an understory of grasses, 20 percent is cultivated, and 30 percent is pasture, hayland, or range. Livestock farming and cash grain farming are the main farm

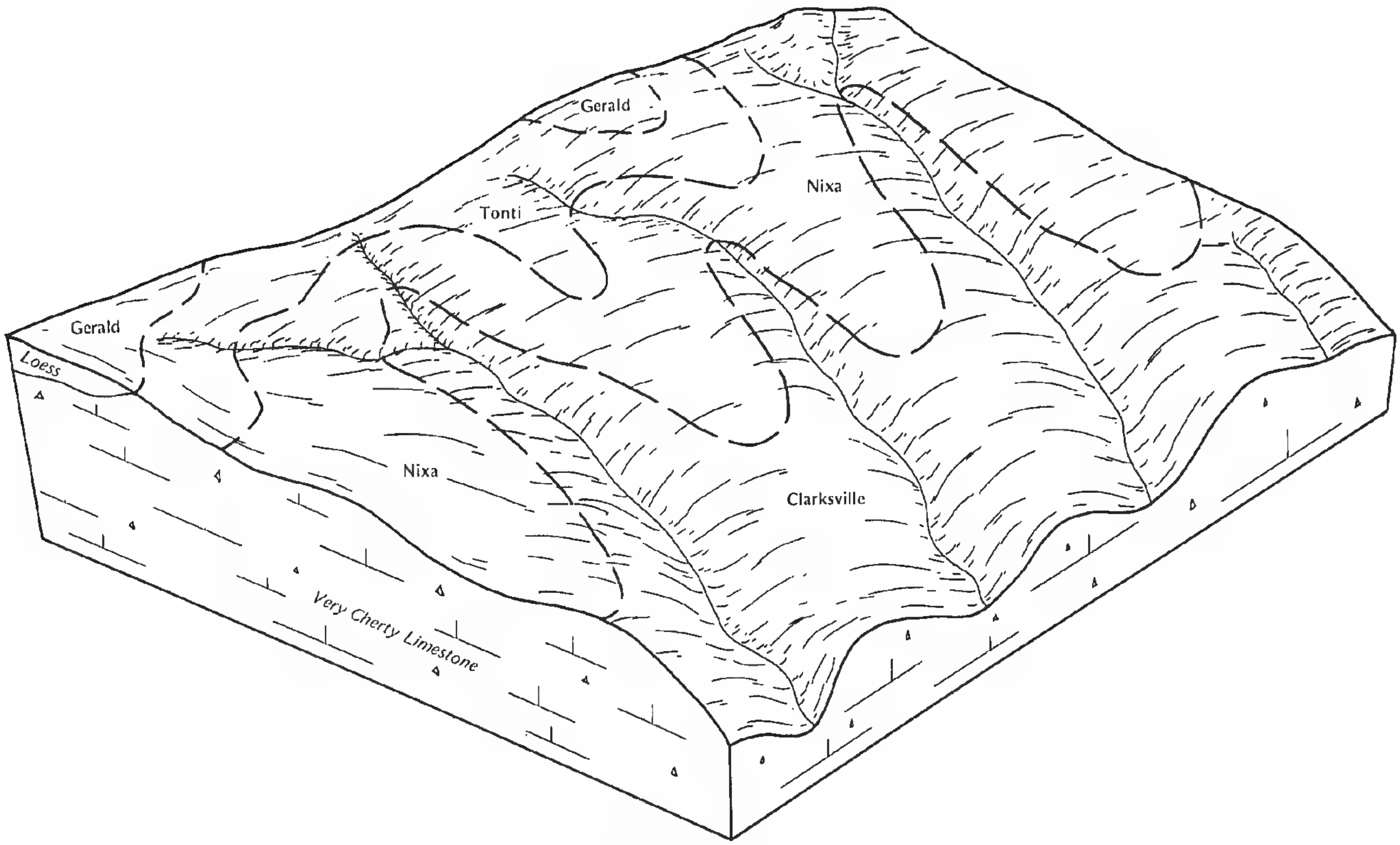

Figure 6.—Typical pattern of soils and underlying material in the Clarksville-Nixa-Tonti association.

enterprises. The principal crops are wheat, grain sorghum, and soybeans. The main management needs are measures that maintain or increase grass or tree production on range or pasture.

8. Kanima Association

Deep, moderately sloping to steep, well drained, shaly and silty soils; on uplands

This association consists of rough, irregularly shaped piles, ridges, and hills of mine spoil. The mine spoil includes soil material and fragments of sandstone and coal. Slope ranges from 3 to 50 percent.

This association makes up about 6 percent of the county. It is about 82 percent Kanima soils, 8 percent water areas, and 10 percent minor soils.

Typically, the surface layer of the Kanima soils is very dark grayish brown shaly silty clay loam about 6 inches thick. The substratum to a depth of about 60 inches is dark brown extremely shaly silty clay loam. In some areas the soil has a subsoil of extremely shaly silty clay or silty clay.

The minor soils in this association are Parsons and Dennis soils in undisturbed areas. Parsons soils are nearly level and are on broad flats. Dennis soils are gently sloping and are on side slopes.

This association is used mainly as wildlife habitat, pasture, and recreation areas. In most areas the Kanima soils are scantly covered with trees, brush, weeds, and undesirable grasses. About one-third of the association supports tame grasses. Clearing brush and smoothing the dumps and seeding them to adapted grasses improve the suitability of the Kanima soils for pasture.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Bates loam, 1 to 3 percent slopes, is one of several phases in the Bates series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Bates-Collinsville complex, 4 to 15 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Dumps, mine, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

The descriptions and names of the soils identified on the detailed maps of this county do not fully agree with those of the soils identified on the maps of adjacent counties. Differences result from a better knowledge of soils, modification of series concepts, a higher or lower intensity of mapping, and variations in the extent of the soils in the counties.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

Be—Bates loam, 1 to 3 percent slopes. This moderately deep, gently sloping, well drained soil is on convex ridgetops, side slopes, and mounds in the uplands. Individual areas are irregular in shape and range from 20 to 300 acres in size.

Typically, the surface soil is very dark grayish brown loam about 13 inches thick. The subsoil is about 21 inches thick. The upper part is dark brown, mottled, friable loam, and the lower part is dark brown, mottled, firm clay loam. Soft sandstone bedrock is at a depth of about 34 inches. In places the surface layer is cobbly loam.

Included with this soil in mapping are small areas of Collinsville and Dennis soils. The shallow Collinsville soils generally are more sloping than the Bates soil. The deep Dennis soils have a dominantly clayey subsoil. They are on side slopes. Included soils make up 10 to 15 percent of the map unit.

Permeability and available water capacity are moderate in the Bates soil. Surface runoff is medium. Tilth is good. Root penetration is restricted below a depth of about 34 inches. Reaction generally is slightly acid in the topsoil, but it varies widely as a result of local liming practices.

Most areas are used for cultivated crops. The rest are used as pasture. This soil is well suited to soybeans, grain sorghum, and wheat. It is poorly suited to corn and alfalfa because of seasonal droughtiness and the moderate available water capacity. Measures that control erosion, maintain tilth, and increase the content of organic matter are the main management needs. Examples are keeping tillage at a minimum, returning crop residue to the soil, establishing grassed waterways, terracing, and farming on the contour. Soil depth should be considered when a terrace system is designed. In a few areas where terraces have been built, the root zone is severely restricted because most of the soil overlying the bedrock has been removed.

This soil is well suited to tame grass pasture. Applications of fertilizer, proper stocking rates, rotation grazing, and a timely season of use increase forage production.

This soil is well suited to dwellings and local roads and streets. The depth to bedrock is a limitation on sites for dwellings with basements, but the rock is soft and can easily be excavated. Low strength is a limitation on sites for roads. Roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil.

Mainly because of the depth to bedrock, this soil is generally unsuited to septic tank absorption fields and sewage lagoons. Suitable sites for lagoons commonly are available in the nearby areas of more clayey soils on the lower side slopes.

The land capability classification is IIe.

Bf—Bates loam, 3 to 6 percent slopes. This moderately deep, moderately sloping, well drained soil is on convex ridgetops, side slopes, and knolls in the uplands. Individual areas are irregularly shaped or long and narrow and range from 20 to 100 acres in size.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The subsoil is about 17 inches thick. The upper part is very dark grayish brown, friable loam, and the lower part is dark brown, mottled, firm clay loam. Soft sandstone bedrock is at a depth of about 24 inches. In places the surface layer is cobbly loam.

Included with this soil in mapping are small areas of Collinsville and Dennis soils. The shallow Collinsville soils generally are more sloping than the Bates soil. The deep Dennis soils are on the lower side slopes. Included soils make up 10 to 15 percent of the map unit.

Permeability and available water capacity are moderate in the Bates soil. Surface runoff is medium. Tilth is good. Root penetration is restricted below a depth of about 24 inches. Reaction generally is slightly acid in the topsoil, but it varies widely as a result of local liming practices.

Most areas are used for cultivated crops. The rest are used as pasture. This soil is moderately well suited to soybeans, grain sorghum, and wheat. It is poorly suited to corn and alfalfa because of seasonal droughtiness and the moderate available water capacity. Measures that control erosion, maintain tilth, and increase the content of organic matter are the main management needs. Examples are keeping tillage at a minimum, returning crop residue to the soil, establishing grassed waterways, terracing, and farming on the contour. Soil depth should be considered when a terrace system is designed. In a few areas where terraces have been built, the root zone is severely restricted because most of the soil overlying the bedrock has been removed.

This soil is well suited to tame grass pasture. Overgrazing, however, reduces the vigor and retards the growth of the grasses. Applications of fertilizer, proper stocking rates, rotation grazing, and a timely season of use increase forage production.

This soil is well suited to dwellings and local roads and streets. The depth to bedrock is a limitation on sites for dwellings with basements, but the rock is soft and can easily be excavated. Low strength is a limitation on sites for roads. Roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil.

Mainly because of the depth to bedrock, this soil is generally unsuited to septic tank absorption fields and sewage lagoons. Suitable sites for lagoons commonly are available in the nearby areas of more clayey soils on the lower side slopes.

The land capability classification is IIIe.

Bh—Bates-Collinsville complex, 4 to 15 percent slopes. These moderately sloping and strongly sloping, well drained soils are on the sides and tops of ridges in the uplands. The shallow Collinsville soil generally is more sloping than the moderately deep Bates soil. Individual areas are long and narrow or irregularly shaped and range from 20 to 200 acres in size. They are about 45 percent Bates soil and 40 percent Collinsville soil. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Bates soil has a surface layer of very dark grayish brown loam about 8 inches thick. The subsoil is about 19 inches thick. The upper part is very dark grayish brown, friable loam, and the lower part is dark brown, mottled, firm clay loam. Soft sandstone bedrock is at a depth of about 27 inches. In places the surface layer is cobbly loam.

Typically, the Collinsville soil has a surface soil of very dark grayish brown fine sandy loam. Sandstone bedrock is at a depth of about 14 inches.

Included with these soils in mapping are small areas of Dennis and Eram soils. The deep Dennis soils are on the lower part of side slopes, and the moderately well drained Eram soils are on the upper part. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the Bates soil and moderately rapid in the Collinsville soil. Available water capacity is moderate in the Bates soil and very low in the Collinsville soil. Surface runoff is medium on both soils. Root penetration is restricted at a depth of about 27 inches in the Bates soil and 14 inches in the Collinsville soil.

Most areas support native grass and are used as range or hayland. A few areas are used as tame grass pasture. These soils generally are unsuitable for cultivation because erosion is a severe hazard. They are well suited to range, pasture, and hay. The native vegetation dominantly is big bluestem, little bluestem, and indiangrass. The major concerns of management are undesirable plants and erosion. If the native range or tame grass pasture is overgrazed, the more desirable grasses and forbs are replaced by less productive mid and short grasses and by weeds and brush. After continued heavy grazing, the plant community is invaded by broomsedge bluestem, broomweed, osageorange, and other less desirable vegetation. Proper stocking rates, a uniform distribution of grazing, and brush control help to keep the range in good condition.

If these soils are used for tame grass pasture, applications of fertilizer, proper stocking rates, rotation grazing, a timely season of use, and brush control increase forage production. Forage production is low on abandoned cropland. It can be increased by seeding desirable mid and tall grasses.

The Bates soil is well suited to dwellings and local roads and streets. The depth to bedrock is a limitation on sites for dwellings with basements, but the rock is soft and can be easily excavated. Low strength is a limitation on sites for roads. Roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil.

Mainly because of the depth to bedrock, the Bates soil is generally unsuited to septic tank absorption fields and sewage lagoons. Suitable sites for lagoons commonly are available in the nearby areas of more clayey soils on the lower side slopes.

The Collinsville soil generally is unsuited to building site development and sanitary facilities because it is shallow over bedrock.

The land capability classification is VIe.

Bo—Bolivar-Hector fine sandy loams, 4 to 15 percent slopes. These moderately sloping and strongly sloping, well drained soils are on ridgetops and side slopes in the uplands. In most areas they are dissected by drainageways. The Bolivar soil is moderately deep, and the Hector soil is shallow. Individual areas are irregularly shaped and range from 20 to 80 acres in size. They are about 65 percent Bolivar soil and 25 percent Hector soil. The two soils occur as areas so small or so intricately mixed that mapping them separately is not practical.

Typically, the Bolivar soil has a surface layer of very dark grayish brown fine sandy loam about 5 inches thick. The subsurface layer is brown, very friable fine sandy loam about 7 inches thick. The subsoil is mottled, friable clay loam about 24 inches thick. The upper part is brown, and the lower part is strong brown. Bedrock is at a depth of about 36 inches.

Typically, the Hector soil has a surface layer of dark brown fine sandy loam about 3 inches thick. The subsurface layer is brown, very friable fine sandy loam about 4 inches thick. The subsoil is reddish brown, very friable fine sandy loam about 8 inches thick. Bedrock is at a depth of about 15 inches.

Included with these soils in mapping are small areas of the deep Dennis soils on foot slopes. These included soils make up less than 10 percent of the map unit.

Permeability is moderate in the Bolivar soil and moderately rapid in the Hector soil. Available water capacity is low in the Bolivar soil and very low in the Hector soil. Surface runoff is medium on both soils. The root zone is restricted by the bedrock at a depth of about 36 inches in the Bolivar soil and 15 inches in the Hector soil. The shrink-swell potential is moderate in the subsoil of the Bolivar soil.

Most of the acreage is woodland that has an understory of shrubs and grasses (fig. 7). These areas are used mainly for grazing. Because erosion is a severe hazard and the rockiness interferes with tillage, these soils generally are unsuited to cultivated crops. They are moderately well suited to trees. Most of the trees are used for firewood or charcoal. Because of the restricted root zone, the growth rate is only moderate and the quality of the timber is only fair. The growth rate and quality can be improved by removing undesirable trees, protecting the woodland from fire, and fencing to control grazing.

These soils are moderately well suited to range and tame grass pasture. The dominant vegetation is post oak and blackjack oak and an understory of big bluestem, little bluestem, and indiangrass. If the range or pasture is overgrazed, the more desirable grasses are replaced by less productive grasses, such as broomsedge bluestem, and by broomweed. Measures that thin the canopy, proper stocking rates, timely deferment of grazing, and brush control help to keep the range in good condition.

The diverse vegetation of trees, shrubs, and grasses provides good habitat for many wildlife species, including quail, deer, wild turkey, rabbits, and numerous songbirds. Proper grazing use, brush management, and establishment of feed areas increase the wildlife population.

The Bolivar soil is moderately well suited to dwellings. The shrink-swell potential and the slope are limitations. Also, the depth to bedrock is a limitation on sites for dwellings with basements, but the rock is soft and can

Figure 7.—Blackjack oak and post oak in an area of Bolivar-Hector fine sandy loams, 4 to 15 percent slopes.

be easily excavated. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with suitable coarse material help to prevent the structural damage caused by shrinking and swelling. If the less sloping areas are selected as sites for dwellings, less leveling will be needed during construction.

Because of low strength, the shrink-swell potential, and the slope, the Bolivar soil is only moderately well suited to local roads and streets. The roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to prevent the road damage caused by shrinking and swelling. If the less sloping areas are selected as sites for roads and streets, less leveling and earthmoving will be needed during construction.

Mainly because of the depth to bedrock, the Bolivar soil is generally unsuited to septic tank absorption fields

and sewage lagoons. Suitable sites for lagoons commonly are available in the nearby areas of more clayey soils on the lower side slopes.

The Hector soil generally is unsuited to building site development because it is shallow over bedrock.

The land capability classification is VIe.

Br—Brazilton silty clay loam, 1 to 3 percent slopes. This deep, gently sloping, moderately well drained soil is on ridgetops and terraces. The topsoil and subsoil in these areas were stockpiled, and the substratum and underlying material were strip mined. Later, the areas were shaped and smoothed, and the subsoil and topsoil were replaced. Individual areas are generally rectangular and range from 10 to 100 acres in size.

Typically the surface layer is very dark grayish brown silty clay loam about 8 inches thick. The subsoil is very dark gray, very firm silty clay about 32 inches thick. The substratum to a depth of about 60 inches is dark gray and yellowish brown extremely shaly silty clay. In places fragments of coal, limestone, and shale are exposed. In some small areas the soil material is extremely acid.

Permeability is very slow, and available water capacity is low. Surface runoff is medium. In most areas the surface layer and subsoil are compacted. The shrink-swell potential is high in the subsoil. The surface layer is medium acid.

Nearly all areas are used as tame grass pasture or are seeded to wheat or sorghum. This soil is moderately well suited to most cultivated crops. Erosion, soil compaction, and the small areas of extremely acid soil material are concerns of management. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss and increases the water intake rate. Applications of lime and fertilizer improve fertility.

This soil is suited to tame grass pasture or to native grass. In the areas used as tame grass pasture, applications of fertilizer, proper stocking rates, rotation grazing, and a timely season of use increase forage production.

This soil is moderately well suited to dwellings and local roads and streets. The shrink-swell potential is a limitation if the soil is used as a site for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling. Low strength and the shrink-swell potential are limitations on sites for local roads and streets. The roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to prevent the road damage caused by shrinking and swelling.

Because the very slow permeability is a severe limitation, this soil generally is unsuitable as a septic tank absorption field. It is only moderately well suited to sewage lagoons because of seepage. Sealing the lagoons with less permeable material helps to control seepage.

The land capability classification is IIIe.

Cd—Catoosa silt loam, 0 to 2 percent slopes. This moderately deep, nearly level, well drained soil is on the tops of ridges in the uplands. Individual areas are irregular in shape and range from 20 to 200 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsurface layer is dark brown, friable silt loam about 5 inches thick. The subsoil is dark reddish brown, firm silty clay loam about 16 inches thick. Limestone bedrock is at a depth of about 28 inches. In places the depth to bedrock is more than 40 inches. In some small areas limestone or chert fragments are on the surface and throughout the soil.

Included with this soil in mapping are small areas of Shidler and Zaar soils. The shallow Shidler soils are on the steeper side slopes. The clayey Zaar soils are along drainageways. Also included are small areas where rock crops out. Included areas make up 5 to 15 percent of the map unit.

Permeability and available water capacity are moderate in the Catoosa soil. Surface runoff is medium. Tilth is good. The shrink-swell potential is moderate in the subsoil. Root penetration is restricted below a depth of about 28 inches. Reaction is generally medium acid in the topsoil, but it varies widely as a result of local liming practices.

Most areas are used for cultivated crops. A few are used as pasture. This soil is well suited to soybeans, grain sorghum, wheat, and tall fescue. It is poorly suited to corn and alfalfa because of seasonal droughtiness. If cultivated crops are grown, erosion is a hazard. The efficient use of the available water also is a concern of management. Grassed waterways, terraces, and minimum tillage help to prevent excessive soil loss and conserve moisture. Soil depth should be considered when a terrace system is designed.

This soil is well suited to tame grass pasture. Overgrazing, however, reduces the vigor and retards the growth of the grasses. Applications of fertilizer, proper stocking rates, rotation grazing, and a timely season of use increase forage production.

This soil is moderately well suited to dwellings. The shrink-swell potential and the depth to bedrock are limitations. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling. The areas where the depth to bedrock is more than 40 inches generally should be selected as sites for dwellings, especially dwellings with basements.

Because of the shrink-swell potential and the depth to bedrock, this soil is only moderately well suited to local

roads and streets. Providing coarser grained base material helps prevent the road damage caused by shrinking and swelling.

Mainly because of the depth to bedrock, this soil generally is unsuitable as a septic tank absorption field and is poorly suited to sewage lagoons. The areas where the depth to bedrock is more than 40 inches generally can be used as sites for lagoons.

The land capability classification is IIe.

Ce—Cherokee silt loam, 0 to 1 percent slopes. This deep, nearly level, somewhat poorly drained soil is on broad upland flats. Individual areas are irregular in shape and range from 40 to 900 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is grayish brown, mottled, friable silt loam about 7 inches thick. The subsoil is mottled, very firm clay about 33 inches thick. The upper part is very dark grayish brown, the next part is dark grayish brown, and the lower part is grayish brown. The substratum to a depth of about 60 inches is grayish brown, mottled silty clay loam. In some areas the subsurface layer is very dark grayish brown.

Permeability is very slow, and available water capacity is high. Surface runoff is slow. Tilth is good. The shrink-swell potential is high in the subsoil. A perched seasonal high water table is within a depth of 1 foot. The topsoil generally is neutral but may be medium acid in areas where it is not limed.

Nearly all areas are used for cultivated crops. This soil is well suited to alfalfa, soybeans, grain sorghum, corn, and wheat. Crop yields are adversely affected during dry periods, however, because the clayey subsoil fails to release water readily to plants. Also, the wetness can delay tillage and reduce yields. It can be reduced by drainage ditches. Keeping tillage at a minimum and leaving crop residue on the surface help to maintain tilth and increase the content of organic matter.

This soil is moderately well suited to dwellings. The wetness and the shrink-swell potential are limitations. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material help to prevent the structural damage caused by wetness and by shrinking and swelling.

Because of low strength, the wetness, and the shrink-swell potential, this soil is only moderately well suited to local roads and streets. The roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to prevent the road damage caused by shrinking and swelling. Building the roads on raised fill material, establishing adequate side ditches, and installing culverts reduce the wetness.

This soil is well suited to sewage lagoons. Because of the very slow permeability, however, it generally is unsuitable as a septic tank absorption field.

The land capability classification is IIs.

Ck—Clarksville very cherty silt loam, 10 to 30 percent slopes. This deep, strongly sloping and moderately steep, somewhat excessively drained soil is on side slopes in the uplands. Individual areas are long and narrow and range from 20 to more than 200 acres in size.

Typically, the surface layer is dark grayish brown very cherty silt loam about 4 inches thick. The subsurface layer is brown, friable very cherty silt loam about 19 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is dark brown, firm very cherty silty clay loam. The lower part is yellowish red, firm extremely cherty silty clay loam. In some areas the lower part of the subsoil has fewer chert fragments. In other areas the soil has a fragipan.

Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is rapid.

Most of the acreage is woodland that has an understory of shrubs and grasses (fig. 8). About two-thirds of the acreage is used as range. A few small areas have been cleared and seeded to tame grasses. This soil generally is unsuited to cultivated crops because of the slope and the many chert fragments on the surface and throughout the profile.

This soil is moderately well suited to range and tame grass pasture. The native grasses dominantly are big bluestem, little bluestem, and indiangrass. Overgrazing destroys the productive plant cover and causes deterioration of the plant community. Under these conditions, the more desirable grasses are replaced by less productive mid and short grasses, such as broomsedge bluestem, and by broomweed and other weeds. The major concerns in managing range are the hazard of erosion and the competing trees. An adequate plant cover and ground mulch reduce the runoff rate, help to prevent excessive soil loss, and increase the moisture supply. Measures that thin the canopy, proper stocking rates, timely deferment of grazing, and brush control help to keep the range in good condition.

This soil is well suited to trees. The equipment limitation and seedling mortality are concerns of management. Because of the cherty texture, hand planting is needed in places. Planting special stock of a larger size than is typical or planting containerized stock helps to achieve better survival. Adequate site preparation, spraying, and cutting or girdling control plant competition. Important species include upland oaks, green ash, and hackberry.

The diverse vegetation of trees, shrubs, and grass provides good habitat for wildlife, such as deer, raccoon, quail, turkey, and numerous songbirds. Brush management and establishment of feed areas increase the wildlife population.

Because of the slope, this soil is poorly suited to dwellings and local roads and streets. The less sloping

Figure 8.—A wooded area of Clarksville very cherty silt loam, 10 to 30 percent slopes.

parts of the landscape should be selected as sites for buildings. Building roads on the contour and establishing vegetation as soon as possible on road cuts help to prevent excessive soil loss.

The less sloping areas of this soil are moderately well suited to septic tank absorption fields. The soil is generally unsuited to sewage lagoons because of seepage and the slope.

The land capability classification is VIIs.

Db—Dennis silt loam, 1 to 3 percent slopes. This deep, gently sloping, moderately well drained soil is on side slopes and low knolls in the uplands. Individual areas are irregular in shape and range from 40 to 200 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 4 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is dark brown, mottled, friable silty clay loam. The next part is dark brown and brown, mottled, firm and very firm silty clay. The lower part is gray and strong brown, mottled, very firm silty clay and firm silty clay loam. In some areas the upper part of the subsoil is silty clay.

Figure 9.—Terraces in an area of Dennis silt loam, 1 to 3 percent slopes.

Included with this soil in mapping are small areas of the moderately deep Bates soils on the upper side slopes. Also included are small areas of alkali soils and slick spots. Included soils make up 5 to 10 percent of the map unit.

Permeability is slow in the Dennis soil, and available water capacity is high. Surface runoff is medium. Tilth is good. The shrink-swell potential is high in the subsoil. A perched seasonal high water table is at a depth of 2 to 3 feet. Reaction is generally medium acid in the topsoil, but it varies widely as a result of local liming practices.

About 75 percent of the acreage is used for cultivated crops. The rest is used as pasture. This soil is well suited to alfalfa, soybeans, grain sorghum, corn, and wheat. Measures that control erosion, maintain tilth, and increase the content of organic matter are the main management needs. Examples are keeping tillage at a minimum, leaving crop residue on the surface, establishing grassed waterways, terracing, and farming on the contour (fig. 9).

This soil is well suited to tame grass pasture. Overgrazing, however, reduces the vigor and retards the growth of the grasses. Under these conditions, the taller grasses are replaced by less productive grasses, by weeds, such as broomweed, and by osageorange. Applications of fertilizer, proper stocking rates, rotation grazing, and a timely season of use increase forage production.

This soil is moderately well suited to dwellings and local roads and streets. The shrink-swell potential is a limitation. Also, the wetness is a limitation on sites for dwellings with basements, and low strength is a limitation on sites for local roads and streets. Properly designing and reinforcing foundations, installing

foundation drains, and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling and by wetness. Roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to prevent the road damage caused by shrinking and swelling.

Because of the slow permeability and the wetness, this soil generally is unsuitable as a septic tank absorption field. It is well suited to sewage lagoons. Because of the slope, however, some land shaping generally is needed.

The land capability classification is IIe.

Du—Dumps, mine. This map unit consists of piles of rock and chat from lead and zinc mines in the southeastern part of the county (fig. 10). Individual areas are irregular in shape and range from 5 to 80 acres in size.

Typically, the piles of chat and rock are large. In some areas, however, the cover of rock and chat is thin. Most areas support no vegetation.

This unit is unsuited to cultivated crops and to pasture and most other uses. Some areas are suited to the development of wildlife habitat.

No land capability classification is assigned to this unit.

En—Eram silty clay loam, 3 to 7 percent slopes. This moderately deep, moderately sloping, moderately

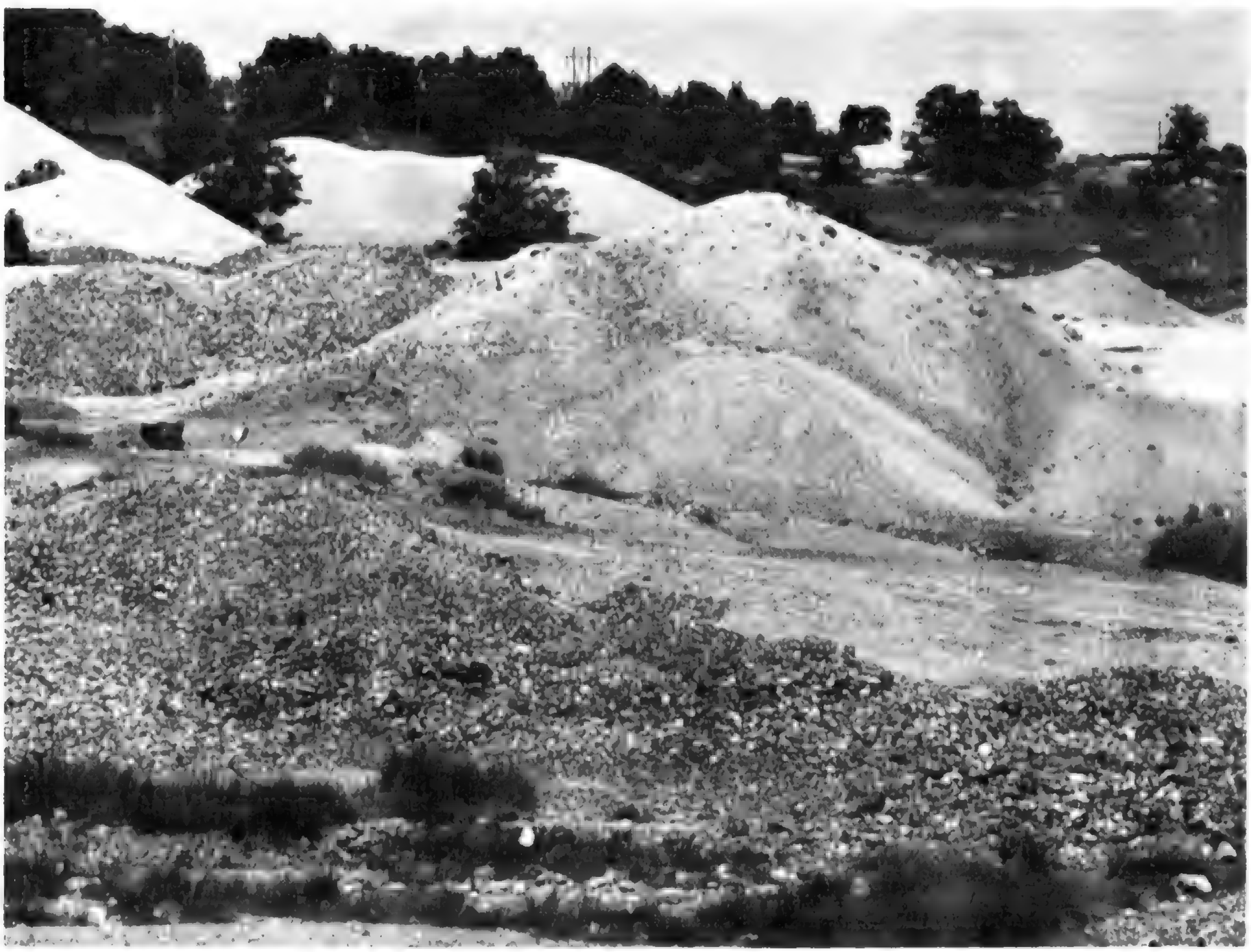

Figure 10.—An area of Dumps, mine.

well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from 20 to 100 acres in size.

Typically, the surface layer is very dark grayish brown silty clay loam about 11 inches thick. The subsoil is dark grayish brown and brown, mottled, very firm silty clay about 21 inches thick. Shale bedrock is at a depth of about 32 inches. In places the surface layer is silty clay. In some small areas the depth to shale is more than 40 inches. In some areas seams of lime are in the lower part of the subsoil.

Included with this soil in mapping are small areas of the deep Zaar soils on the lower side slopes. These soils make up 5 to 10 percent of the map unit.

Permeability is slow in the Eram soil, and available water capacity is low. Surface runoff is medium. Tilth is good. The shrink-swell potential is high in the subsoil. A perched seasonal high water table is at a depth of 2 to 3 feet. The topsoil generally is slightly acid. Root penetration is restricted below a depth of 32 inches.

About half of the areas are used for cultivated crops. The rest are used as pasture. This soil is suited to soybeans, grain sorghum, and wheat. It is poorly suited to corn and alfalfa because of seasonal droughtiness and the low available water capacity. Measures that control erosion, improve tilth, and increase the content of organic matter are the main management needs. Examples are keeping tillage at a minimum, leaving crop residue on the surface, establishing grassed waterways, terracing, and farming on the contour. The depth to bedrock should be considered when a terrace system is designed.

This soil is well suited to tame grass pasture. Overgrazing, however, reduces the vigor and retards the growth of the grasses. Under these conditions, the taller grasses are replaced by less productive grasses and by weeds. Applications of fertilizer, proper stocking rates, rotation grazing, and a timely season of use increase forage production.

This soil is moderately well suited to dwellings and local roads and streets. The shrink-swell potential is a limitation. Also, the wetness is a limitation on sites for dwellings with basements, and low strength is a limitation on sites for local roads and streets. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling and by wetness. Roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to prevent the road damage caused by shrinking and swelling.

Because of the depth to bedrock, the wetness, and the slow permeability, this soil generally is unsuitable as a septic tank absorption field. It is poorly suited to sewage lagoons because of the depth to bedrock. Borrowing soil or ripping the bedrock during construction of the lagoons helps to overcome the moderate depth to bedrock. Sealing the bottom of the lagoon helps to prevent excessive seepage into fractures in the bedrock. Some land shaping may be needed to keep surface water away from the lagoon.

The land capability classification is IVe.

Es—Eram-Shidler silty clay loams, 4 to 12 percent slopes. These moderately sloping and strongly sloping soils are on the sides and tops of ridges in the uplands. The moderately deep, moderately well drained Eram soil generally is more sloping than the shallow, well drained Shidler soil. Individual areas are long and narrow or irregularly shaped and range from 20 to 200 acres in size. They are about 50 percent Eram soil and 40 percent Shidler soil. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Eram soil has a very dark grayish brown silty clay loam surface layer about 8 inches thick. The subsoil is dark grayish brown, mottled, very firm silty clay about 18 inches thick. Shale bedrock is at a depth of about 26 inches. In places the surface layer is silty clay. In some small areas the depth to shale is more than 40 inches. In some areas seams of lime are in the lower part of the subsoil.

Typically, the Shidler soil has a very dark brown silty clay loam surface layer about 12 inches thick. This layer has some limestone fragments. It is underlain by hard limestone at a depth of about 12 inches.

Included with these soils in mapping are small areas of the deep Dennis and Zaar soils on the lower side slopes. Also included are small areas where limestone crops out. Included areas make up about 10 percent of the map unit.

Permeability is slow in the Eram soil and moderate in the Shidler soil. Available water capacity is low in both soils. Surface runoff is rapid. The Eram soil has a high shrink-swell potential in the subsoil. It has a perched seasonal high water table at a depth of 2 to 3 feet. Root penetration is restricted at a depth of about 26 inches in the Eram soil and 12 inches in the Shidler soil.

Nearly all areas are used as range. Because of a severe hazard of erosion on both soils and the shallowness to limestone in the Shidler soil, this map unit generally is unsuited to cultivated crops. It is well suited to range and moderately well suited to tame grass pasture. The native grasses dominantly are big bluestem and little bluestem. Sideoats grama is more common on the shallow Shidler soil than on the Eram soil. If the pasture or range is overgrazed, the more desirable grasses and forbs are replaced by less productive grasses and by weeds and brush. After continued heavy grazing, the plant community is invaded by broomsedge bluestem, broomweed, osageorange, and other less desirable vegetation. Proper stocking rates, a uniform

distribution of grazing, and brush control help to keep the range in good condition.

If these soils are used for tame grass pasture, applications of fertilizer, proper stocking rates, rotation grazing, a timely season of use, and brush control increase forage production. Forage production is low on abandoned cropland. It can be increased by seeding desirable mid and tall grasses.

The Eram soil is moderately well suited to dwellings and local roads and streets. The shrink-swell potential is a limitation. Also, the wetness is a limitation on sites for dwellings with basements, and low strength is a limitation on sites for local roads and streets. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling and by wetness. Roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to prevent the road damage caused by shrinking and swelling.

Because of the depth to bedrock, the wetness, and the slow permeability, the Eram soil generally is unsuitable as a septic tank absorption field. It is poorly suited to sewage lagoons because of the depth to bedrock. The included soils on the lower side slopes are good sites for sewage lagoons.

The Shidler soil generally is unsuited to building site development because it is shallow over bedrock.

The land capability classification is VIe.

Ge—Gerald silt loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on the tops of ridges in the uplands. Individual areas are irregular in shape and range from 40 to 100 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown, mottled, friable silt loam about 5 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is dark brown, mottled, firm silty clay. The next part is a fragipan of dark brown, brown, and strong brown, firm silty clay loam and yellowish red and light reddish brown, mottled, very firm very cherty silty clay loam. The lower part is yellowish red, mottled, very firm extremely cherty silty clay. In some areas the part of the subsoil above the fragipan is silty clay loam.

Included with this soil in mapping are small areas of Nixa soils on side slopes. These soils have a cherty surface layer. They make up about 5 to 10 percent of the map unit.

Permeability is moderate in the upper part of the Gerald soil and very slow in the fragipan. Available water capacity is moderate. Surface runoff is slow. The surface layer is friable and can be easily tilled. The shrink-swell potential is high in the subsoil. A perched seasonal high water table is at a depth of 1 to 2 feet. The root zone is limited by the fragipan at depth of about 22 inches. Reaction in the topsoil generally is very strongly acid, but it varies widely as a result of local liming practices.

About half the acreage is cultivated. The rest is used as tame grass pasture or hayland. This soil is moderately well suited to soybeans, grain sorghum, and wheat. The wetness commonly delays tillage in the spring. A surface drainage system is needed in some areas. Also, the clayey subsoil does not readily release moisture to plants. As a result, productivity is reduced during periods of drought. Keeping tillage at a minimum and leaving crop residue on the surface help to maintain tilth and increase the content of organic matter.

This soil is well suited to tame grass pasture and hay. Overgrazing and either mowing hay or grazing during wet periods, however, cause surface compaction. Proper stocking rates, applications of fertilizer, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is moderately well suited to dwellings and local roads and streets. The shrink-swell potential and the wetness are limitations if the soil is used as a site for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling and by wetness. Low strength and the shrink-swell potential are limitations on sites for local roads and streets. Providing coarser grained base material helps to prevent the road damage caused by shrinking and swelling and by low strength. Building the roads on raised fill material, establishing adequate side ditches, and installing culverts reduce the wetness.

Because the very slow permeability and the wetness are severe limitations, this soil generally is unsuitable as a septic tank absorption field. It is well suited to sewage lagoons.

The land capability classification is IIIw.

He—Hepler silt loam, occasionally flooded. This deep, nearly level, somewhat poorly drained soil is on terraces along streams. It is occasionally flooded for brief periods. Individual areas are long and narrow or irregularly shaped and range from 40 to 200 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark brown and brown, friable silt loam about 16 inches thick. It is mottled in the lower part. The subsoil to a depth of more than 60 inches is mottled, firm silty clay loam. The upper part is dark grayish brown, and the lower part is grayish brown.

Included with this soil in mapping are small areas of the clayey Osage soils, which make up less than 10

percent of the map unit. These soils are in swales and other concave areas.

Permeability is moderately slow in the Hepler soil, and available water capacity is high. Surface runoff is slow. Tilth is good. The shrink-swell potential is moderate in the subsoil. A seasonal high water table is at a depth of 1 to 3 feet. The topsoil generally is slightly acid.

Nearly all areas are used for cultivated crops. This soil is well suited to alfalfa, soybeans, grain sorghum, corn, wheat, and tall fescue. The main concern of management is the crop damage caused by wetness. Improving tilth and maintaining the content of organic matter are other concerns. Drainage ditches reduce the wetness. Keeping tillage at a minimum and leaving crop residue on the surface improve tilth and increase the content of organic matter.

This soil is well suited to trees. A few areas are used as native woodland. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed. Adequate site preparation, spraying, and cutting or girdling control plant competition. No hazards or limitations affect planting or harvesting. Important species include black walnut, northern red oak, pin oak, pecan, and green ash.

This soil generally is unsuitable for building site development because of the hazard of flooding. Overcoming this hazard is difficult without major flood-control measures.

The land capability classification is IIw.

Hf—Hepler silt loam, frequently flooded. This deep, nearly level, somewhat poorly drained soil is on narrow flood plains that are dissected by drainageways and meandering stream channels (fig. 11). It is frequently flooded for brief periods. Most areas are in upland drainageways. Some areas have deeply entrenched channels. Others have short, steep side slopes. Individual areas are long and about 200 to 500 feet wide and range from 10 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsurface layer is dark grayish brown and pale brown, mottled, friable silt loam about 20 inches thick. The subsoil to a depth of more than 60 inches is mottled, firm silty clay loam. The upper part is dark grayish brown, the next part is strong brown, and the lower part is grayish brown. In some areas the surface layer or subsurface layer is silty clay loam.

Included with this soil in mapping are small areas of the clayey Osage soils, which make up less than 10 percent of the map unit. These soils are in swales and other concave areas.

Permeability is moderately slow in the Hepler soil, and available water capacity is high. Surface runoff is slow. A seasonal high water table is at a depth of 1 to 3 feet. The shrink-swell potential is moderate in the subsoil.

Most areas are used as tame grass pasture. Some are used as range or woodland. This soil is generally unsuited to cultivated crops because the flooding is a hazard and because operating machinery along the meandering stream channels is difficult. Many areas of range are overgrazed and in poor condition because they are near watering facilities and shade trees where cattle congregate. In these areas the more desirable grasses are replaced by less productive grasses and by weeds. Restricted use during wet periods helps to keep the range in good condition. The productivity of the range can be increased by rotation grazing and by restricting grazing to winter months.

If this soil is used for tame grass pasture, applications of fertilizer, proper stocking rates, rotation grazing, a timely season of use, and brush control increase forage production. Reseeding mid or tall grasses in cleared areas also increases forage production.

This soil is well suited to trees. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed. Adequate site preparation, spraying, and cutting or girdling control plant competition. No hazards or limitations affect planting or harvesting. Important species include black walnut, pecan, pin oak, northern red oak, and green ash.

The vegetation commonly grown on this soil provides habitat for many kinds of wildlife, including quail, deer, wild turkey, rabbits, and numerous songbirds. The wildlife population can be increased by increasing the number of fringe areas where woodland is adjacent to cropland.

This soil generally is unsuitable for building site development because the flooding is a severe hazard. Overcoming this hazard is difficult without major flood-control measures.

The land capability classification is Vw.

Ka—Kanima shaly silty clay loam, 3 to 10 percent slopes. This deep, moderately sloping and strongly sloping, well drained soil is in upland areas that formerly were strip mined and then were smoothed and shaped. Individual areas are rectangular and range from 10 to 640 acres in size.

Typically, the surface layer is very dark grayish brown shaly silty clay loam about 6 inches thick. The substratum to a depth of about 60 inches is dark brown extremely shaly silty clay loam. In scattered small areas the original subsoil and underlying material are still intact. In some small areas the soil material is extremely acid.

Permeability is moderate, and available water capacity is low. Surface runoff is medium. Organic matter content is low. Tilth is poor.

Most areas have been seeded to tall fescue, wheat, or clover. A few have been seeded to native grasses. Because of the low available water capacity, this soil generally is not suited to cultivated crops. It is moderately well suited to tall fescue, switchgrass, and western wheatgrass. The major concerns in managing

Figure 11.—An area of Hepler silt loam, frequently flooded, dissected by a stream channel.

pasture or hayland are undesirable plants and low production of grass. Grazing and haying should be deferred until the grass is well established. Lime and fertilizer should be applied according to the results of soil tests and field observations.

This soil is well suited to dwellings and to local roads and streets. Settling can be a problem, however, in a few areas. The soil is moderately well suited to septic tank absorption fields and sewage lagoons. The moderate permeability restricts the absorption of effluent in septic tank absorption fields. Enlarging the field, however, helps overcome this limitation. Seepage and slope are limitations on sites for sewage lagoons. Sealing the lagoon with less permeable material helps to control seepage. Some land shaping commonly is needed to overcome the slope.

The land capability classification is VIs.

Kn—Kanima shaly silty clay loam, 15 to 50 percent slopes. This deep, strongly sloping to steep, well drained soil is in upland areas that formerly were strip mined. Individual areas are irregular in shape and range from 10 to 640 acres in size.

Typically, the surface layer is very dark grayish brown shaly silty clay loam about 6 inches thick. The substratum to a depth of about 60 inches is dark brown extremely shaly silty clay loam (fig. 12). In some areas the substratum is extremely shaly silty clay or silty clay.

Included with this soil in mapping are areas of water and small areas of extremely acid soil. Included areas make up 5 to 15 percent of the map unit.

Permeability is moderate in the Kanima soil, and available water capacity is low. Surface runoff is rapid. Organic matter content is low.

Most of the acreage is idle land. Some areas are used for wildlife habitat or recreation purposes. A few small areas are used for grazing by livestock. The vegetation generally is weeds, annual grasses, and trees. Many

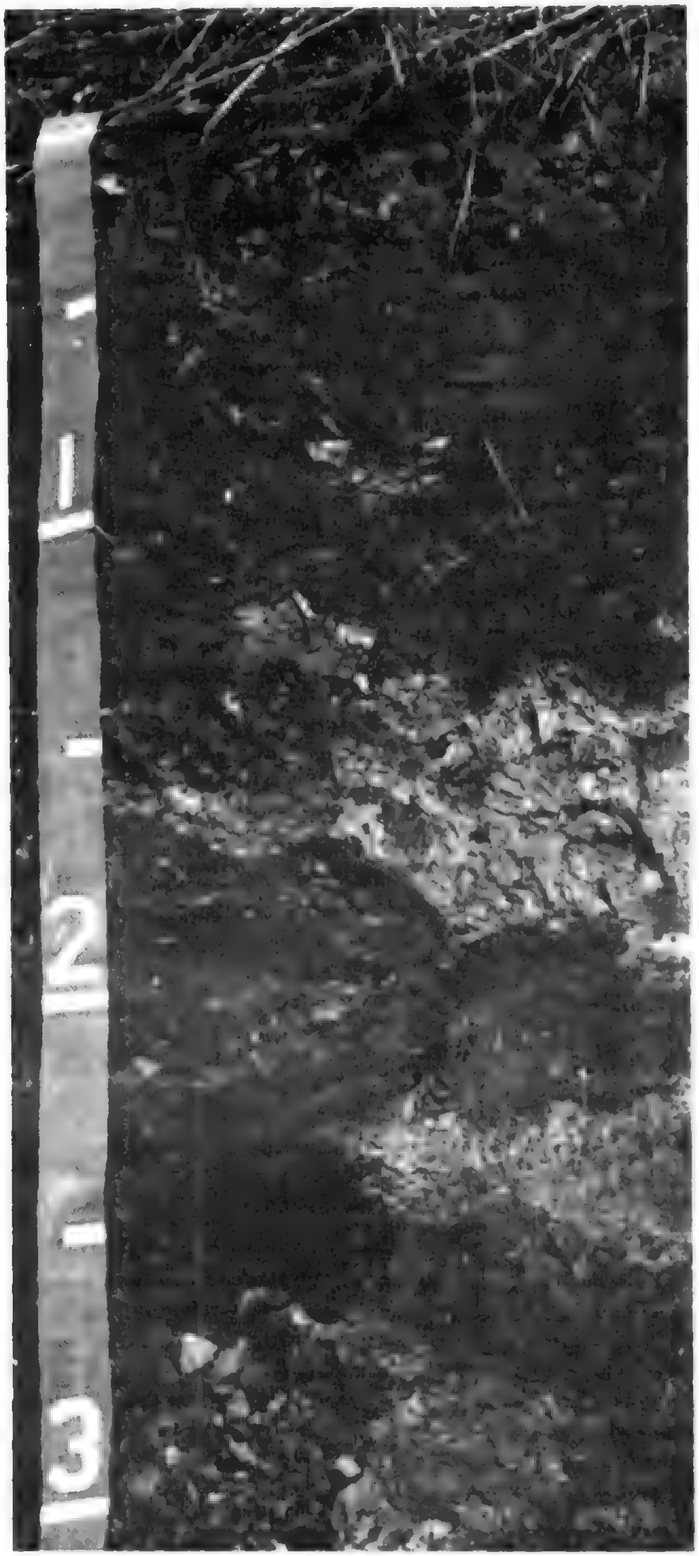

Figure 12.—Profile of Kanima shaly silty clay loam, 15 to 50 percent slopes. The substratum is extremely shaly. Depth is marked in feet.

areas support no vegetation. A few small areas have been seeded to lespedeza or clover.

This soil is not suited to cultivated crops because of the slope and the rock fragments. If the slopes are graded and shaped, the soil is suited to switchgrass, western wheatgrass, tall fescue, and other grasses. Grazing or haying should be deferred until the grass is well established. Fertilizer and lime should be applied according to the results of soil tests and field observations.

This soil is generally not suited to building site development because of the slope. Onsite investigation is needed to determine the suitability of the soil for specific uses.

The land capability classification is VIIs.

Ln—Lanton silt loam, occasionally flooded. This deep, nearly level, somewhat poorly drained soil is on flood plains. It is occasionally flooded for very brief periods. Individual areas are long and narrow or irregularly shaped and range from 40 to 200 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is about 32 inches thick. It is very dark grayish brown. It is friable silt loam in the upper part and firm silty clay loam in the lower part. It is mottled below a depth of about 16 inches. The substratum to a depth of about 60 inches is gray, mottled clay.

Included with this soil in mapping are small areas of the clayey Osage soils, which make up less than 10 percent of the map unit. These soils are in swales and other concave areas.

Permeability is moderately slow in the Lanton soil, and available water capacity is high. Surface runoff is slow. Tilth is good. The shrink-swell potential is moderate in the substratum. A seasonal high water table is at a depth of 1 to 2 feet. The topsoil generally is slightly acid.

Nearly all areas are used for cultivated crops. This soil is well suited to alfalfa, soybeans, grain sorghum, corn, and wheat. The main concern of management is the crop damage caused by wetness. Land smoothing, surface ditches, and tile improve drainage. Keeping tillage at a minimum and leaving crop residue on the surface improve tilth and increase the content of organic matter.

This soil is well suited to trees. A few areas are used as native woodland. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed. Adequate site preparation, spraying, and cutting or girdling control plant competition. No hazards or limitations affect planting or harvesting. Important species include black walnut, pecan, pin oak, northern red oak, green ash, and eastern cottonwood.

This soil is generally unsuited to building site development because of the flooding.

The land capability classification is IIw.

Ns—Nixa cherty silt loam, 2 to 9 percent slopes. This deep, gently sloping and moderately sloping, moderately well drained soil is on side slopes in the uplands. Individual areas are long and narrow and range from 20 to more than 200 acres in size.

Typically, the surface layer is dark grayish brown cherty silt loam about 5 inches thick. The subsurface layer is brown, friable very cherty silt loam about 8 inches thick. The upper part of the subsoil also is brown, friable very cherty silt loam. The next part is a fragipan of yellowish brown, mottled, firm extremely cherty silt loam. The lower part to a depth of about 60 inches is multicolored, firm extremely cherty silty clay loam.

Included with this soil in mapping are small areas of Tonti soils on ridgetops. These soils have less chert in the surface layer and upper part of the subsoil than the Nixa soil. They make up less than 10 percent of the map unit.

Permeability is very slow in the Nixa soil, and available water capacity is moderate. Surface runoff is medium. The topsoil is strongly acid. Root penetration is restricted by the fragipan at a depth of about 18 inches.

Much of the acreage is woodland that has an understory of shrubs and grasses. Most areas are used as range or pasture. This soil is poorly suited to cultivated crops because the chert fragments interfere with tillage.

This soil is best suited to native range, tame grass pasture, and hay. The dominant vegetation is post oak and blackjack oak and an understory of grasses, such as big bluestem and little bluestem. If the range or pasture is overgrazed, the more desirable grasses are replaced by less productive mid and short grasses and by weeds and brush. Grass production is reduced if the scrub oak canopy is too thick (fig. 13). Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition. The trees can be controlled by burning, spraying, or clearing. Forage production is low on abandoned cropland. It can be increased by seeding mid and tall grasses. Hay production can be maintained or increased by mowing when the dominant species reaches the boot stage and by cutting at a height of more than 4 inches.

This soil generally is not productive as woodland. Some trees are cut for firewood. The diverse vegetation of trees, shrubs, and grasses provides good habitat for wildlife, such as deer, quail, wild turkey, and numerous songbirds. Planned control of brush increases the wildlife population.

This soil is well suited to dwellings and local roads and streets. It is generally unsuited to septic tank absorption fields because of the very slow permeability. It is well suited to sewage lagoons. Some land shaping may be needed, however, to keep surface water from entering the lagoon.

The land capability classification is IVs.

Os—Osage silty clay, occasionally flooded. This deep, nearly level, poorly drained soil is on flood plains. It is occasionally flooded for very brief periods. Individual areas are elongated or irregularly shaped and range from 40 to 200 acres in size.

Typically, the surface layer is black silty clay about 6 inches thick. The subsurface layer is black, very firm silty clay about 11 inches thick. It is mottled in the lower part. The subsoil to a depth of about 60 inches is mottled, extremely firm clay. The upper part is very dark gray, and the lower part is dark gray.

Included with this soil in mapping are small areas of the somewhat poorly drained Lanton and moderately well drained Verdigris soils. These soils make up 5 to 10 percent of the map unit. They are less clayey than the Osage soil. Also, Lanton soils are slightly higher on the landscape, and Verdigris soils are nearer the stream channels.

Permeability is very slow in the Osage soil, and available water capacity is moderate. Surface runoff is very slow. Tilth is poor. The shrink-swell potential is very high. A seasonal high water table is within a depth of 1 foot. The topsoil generally is neutral but is more acid in areas where it is not limed.

Most areas are used for cultivated crops. Some are used for pasture or trees. This soil is moderately well suited to alfalfa, soybeans, grain sorghum, corn, wheat, and tall fescue. The wetness can damage crops and delay tillage. Also, the crops are adversely affected during dry periods because the clayey subsoil fails to release water readily to plants. Improving tilth and increasing the content of organic matter are concerns of management. A bedding system and drainage ditches reduce the wetness. Keeping tillage at a minimum and leaving crop residue on the surface improve tilth and increase the content of organic matter.

This soil is well suited to tame grass pasture. Applications of fertilizer, proper stocking rates, rotation grazing, and a timely season of use increase forage production. Restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. A few areas are used as native woodland. The equipment limitation is moderate, and seedling mortality and plant competition are severe. Because of the wetness, the use of equipment is limited to dry periods. Tree seeds, cuttings, and seedlings survive and grow well only if competing vegetation is controlled or removed. Adequate site preparation, spraying, and cutting or girdling control plant competition. Important species include black walnut, eastern cottonwood, pecan, bur oak, northern red oak, and green ash.

This soil generally is unsuited to building site development because of the hazard of flooding. Overcoming this hazard is difficult without major flood-control measures.

The land capability classification is IIIw.

Figure 13.—Grasses in an area of Nixa cherty silt loam, 2 to 9 percent slopes.

Pr—Parsons silt loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on broad flats in the uplands. Individual areas are irregular in shape and range from 40 to 500 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown, mottled, friable silt loam about 6 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is very dark grayish brown and dark grayish brown, mottled, very firm clay. The lower part is gray, yellowish brown, and yellowish red, very firm silty clay. In some areas the depth to the clayey subsoil is more than 16 inches.

Included with this soil in mapping are small areas of Dennis and Zaar soils. The moderately well drained Dennis soils are on side slopes. Zaar soils are along drainageways. They have a clayey surface layer. Included soils make up about 5 to 10 percent of the map unit.

Permeability is very slow in the Parsons soil, and available water capacity is high. Surface runoff is slow. Tilth is good. The shrink-swell potential is high in the subsoil. A perched seasonal high water table is at a depth of 0.5 to 1.5 feet. The topsoil generally is slightly acid but is more acid in areas where it is not limed.

Most areas are used for cultivated crops. A few are used as tame grass pasture. This soil is well suited to alfalfa, soybeans, grain sorghum, corn, and wheat. Crop yields are adversely affected during dry periods, however, because the clayey subsoil fails to release

water readily to plants. Also, the wetness can damage crops and delay tillage. A surface drainage system is needed in some areas. Keeping tillage at a minimum and leaving crop residue on the surface help to maintain tilth and increase the content of organic matter.

This soil is well suited to tame grass pasture. Applications of fertilizer, proper stocking rates, rotation grazing, and a timely season of use increase forage production. Restricted use during wet periods helps to keep the pasture in good condition.

This soil is moderately well suited to dwellings. The wetness and the shrink-swell potential are limitations. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material help to prevent the structural damage caused by wetness and by shrinking and swelling.

Because of low strength, the wetness, and the shrink-swell potential, this soil is only moderately well suited to local roads and streets. The roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to prevent the road damage caused by shrinking and swelling. Building the roads on raised fill material, establishing adequate side ditches, and installing culverts reduce the wetness.

This soil is well suited to sewage lagoons. Because of the very slow permeability, however, it generally is unsuitable as a septic tank absorption field.

The land capability classification is IIs.

Se—Secesh silt loam. This deep, nearly level, well drained soil is on stream terraces. It is subject to rare flooding. Individual areas are irregular in shape and range from 10 to more than 100 acres in size.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil extends to a depth of more than 60 inches. It is dark brown and reddish brown. The upper part is friable or firm silty clay loam, the next part is firm very cherty silt clay loam, and the lower part is friable extremely cherty clay loam. In some areas the surface layer is cherty silt loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Hepler soils on the lower stream terraces. These soils have no chert fragments in the substratum. They make up less than 10 percent of the map unit.

Permeability and available water capacity are moderate in the Secesh soil. Surface runoff is slow. Tilth is good. The surface layer is slightly acid.

Nearly all areas are used for cultivated crops. This soil is well suited to grain sorghum, soybeans, and wheat. It is poorly suited to corn and alfalfa because of the moderate available water capacity. Keeping tillage at a minimum and leaving crop residue on the surface help to maintain good tilth and fertility. Crop rotation helps to control weeds, plant diseases, and insect carryover.

Most areas provide good habitat for wildlife, such as deer, quail, wild turkey, and many nongame birds. The grain fields and wooded areas that border fences produce an abundance of food and cover most of the year.

This soil is poorly suited to dwellings because of the flooding. Onsite inspection and knowledge of the history of flooding in a given area are needed when building sites are selected. The soil is moderately well suited to local roads and streets. Because of the flooding, roads should be built on raised fill material.

This soil is moderately well suited to septic tank absorption fields and sewage lagoons. The moderate permeability and the flooding are limitations on sites for septic tank absorption fields. The moderate permeability restricts the absorption of effluent. Enlarging the field, however, helps overcome this limitation. Levees and dikes are needed to control floodwater. Seepage is a limitation on sites for sewage lagoons. It can be controlled by sealing the lagoon with less permeable material.

The land capability classification is IIs.

Sf—Secesh silt loam, channeled. This deep, nearly level, well drained soil is on stream terraces along upland drainageways. It is frequently flooded. The landscape is cut by meandering stream channels. Individual areas are long and narrow and range from 10 to 300 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil extends to a depth of about 60 inches. It is dark brown and reddish brown. The upper part is friable silty clay loam, the next part is firm very cherty silty clay loam, and the lower part is friable extremely cherty clay loam.

Included with this soil in mapping are areas of Clarksville, Nixa, and Verdigris soils. Clarksville and Nixa soils have more chert in the upper part than the Secesh soil. They are on side slopes. Verdigris soils do not contain chert. They are on flood plains. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the Secesh soil, and available water capacity is high. Surface runoff is slow.

Most areas are used as pasture or hayland. Some are used as woodland. This soil is generally unsuited to cultivated crops because of the flooding and the meandering channels and short, steep slopes, which interfere with tillage. The soil is well suited to native range and to tame grasses for hay or pasture. The native vegetation dominantly is big bluestem, little bluestem, and indiangrass. Overgrazing and either haying or grazing when the soil is too wet cause surface compaction and poor tilth. Overgrazing also reduces the vigor and retards the growth of the grasses. An adequate plant cover helps to prevent excessive soil loss. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the

pasture in good condition. Applications of fertilizer increase forage production in the areas used for tame grasses.

The vegetation commonly grown on this soil provides habitat for many types of wildlife, including quail, deer, wild turkey, rabbits, and numerous songbirds. The wildlife population can be increased by establishing more fringe areas where woodland is adjacent to cropland.

This soil is well suited to trees. Tree cuttings and seedlings grow well if competing vegetation is controlled. Adequate site preparation, controlled burning, and spraying, cutting, or girdling help to control the undesirable vegetation. Important species include black walnut, northern red oak, green ash, and pecan.

This soil is generally unsuited to building site development because of the flooding.

The land capability classification is Vw.

To—Taloka silt loam, 0 to 1 percent slopes. This deep, nearly level, somewhat poorly drained soil is on broad flats in the uplands. Individual areas are irregular in shape and range from 40 to 500 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown and grayish brown, friable silt loam about 13 inches thick. It is mottled in the lower part. The subsoil extends to a depth of more than 60 inches. The upper part is dark grayish brown, mottled, very firm silty clay. The next part is multicolored, very firm silty clay. The lower part is dark grayish brown, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of the moderately well drained Dennis soils, which make up less than 10 percent of the map unit. These soils are in the more sloping areas.

Permeability is very slow in the Taloka soil, and available water capacity is high. Surface runoff is slow. The surface layer is friable and can be easily tilled. The shrink-swell potential is high in the subsoil. A perched seasonal high water table is at a depth of 1 to 2 feet. The topsoil generally is neutral, but it is more acid in areas that have not been limed.

Nearly all areas are used for cultivated crops. This soil is well suited to alfalfa, soybeans, grain sorghum, corn, and wheat. The wetness, however, can damage crops and delay tillage. Also, the crops are adversely affected during dry periods because the clayey subsoil fails to release water readily to plants. Measures that maintain tilth and increase the content of organic matter are needed. Examples are keeping tillage at a minimum and leaving crop residue on the surface. A surface drainage system is needed in a few depressional areas.

This soil is moderately well suited to dwellings. The wetness and the shrink-swell potential are limitations. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material help to prevent the structural damage caused by wetness and by shrinking and swelling.

Because of low strength, the wetness, and the shrink-swell potential, this soil is only moderately well suited to local roads and streets. The roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to prevent the road damage caused by shrinking and swelling. Building the roads on raised fill material, establishing adequate side ditches, and installing culverts reduce the wetness.

This soil is well suited to sewage lagoons. Because of the very slow permeability, however, it generally is unsuitable as a septic tank absorption field.

The land capability classification is IIs.

Tt—Tonti silt loam, 2 to 5 percent slopes. This deep, moderately sloping, moderately well drained soil is on ridgetops and side slopes in the uplands. Individual areas are irregular in shape and range from 10 to more than 200 acres in size.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of more than 60 inches. It is, in sequence downward, yellowish brown, friable cherty silt loam; yellowish brown, mottled, firm cherty silty clay loam; a fragipan of strong brown and light gray, firm very cherty silty clay loam; and red and reddish yellow, firm extremely cherty silty clay loam.

Included with this soil in mapping are small areas of Nixa soils on the more sloping side slopes. These soils have more chert in the surface layer and the upper part of the subsoil than the Tonti soil. They make up less than 10 percent of the map unit.

Permeability is slow in the Tonti soil, and available water capacity is moderate. Surface runoff is medium. Tilth is fair. Root development is restricted in the fragipan. The topsoil is strongly acid.

About one-fourth of the acreage is cultivated. The rest is tame grass pasture or hayland, native hayland, native range, or woodland. This soil is suited to soybeans, grain sorghum, wheat, and tame grasses. Crops are adversely affected during dry periods, however, because the fragipan fails to release water readily to plants. Also, they are damaged during some wet periods. Controlling erosion, maintaining tilth, and increasing the content of organic matter are concerns of management if cultivated crops are grown. Contour farming and minimum tillage help to prevent excessive soil loss. Returning crop residue to the soil improves tilth, conserves moisture, and increases the rate of water infiltration.

This soil is moderately well suited to range. The native grasses dominantly are little bluestem, big bluestem, indiangrass, and wildrye. In areas that are continually overgrazed, these productive grasses are replaced by less desirable plants, such as tall dropseed, western ragweed, broomweed, shrubs, and trees. Proper stocking

rates and rotation grazing help to keep the range in good condition. Native hay production can be maintained or increased by mowing when the dominant species reaches the boot stage and by selecting a cutting height of more than 4 inches.

The pastured areas, which support mainly cool-season grasses, are used for grazing by livestock and for hay. Controlled grazing and timely mowing help to keep the pasture in good condition. Applications of fertilizer improve plant growth and vigor.

This soil generally is not productive as woodland. Some trees are cut for firewood. If managed properly, the soil provides habitat for many wildlife species, including deer, quail, wild turkey, and many nongame birds. Brush management and establishment of feed areas increase the wildlife population.

This soil is well suited to dwellings and local roads and streets. Because of the slow permeability, it generally is unsuited to septic tank absorption fields. It is only moderately well suited to sewage lagoons because of seepage and slope. A sealant can be used to control seepage. Some land shaping may be needed to keep surface water away from the lagoon.

The land capability classification is IVe.

Vb—Verdigris silt loam, occasionally flooded. This deep, nearly level, moderately well drained soil is on flood plains. It is occasionally flooded for very brief periods. Individual areas are long and narrow or irregularly shaped and range from 4 to 100 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 38 inches thick. The substratum to a depth of about 60 inches is dark grayish brown silt loam.

Included with this soil in mapping are small areas of the poorly drained Osage soils. These soils are in swales and other concave areas. They make up 5 to 10 percent of the map unit.

Permeability is moderate in the Verdigris soil, and available water capacity is high. Surface runoff is slow. Tilth is good. The shrink-swell potential is moderate in the subsoil. The topsoil is medium acid.

Nearly all areas are used for cultivated crops. This soil is well suited to alfalfa, soybeans, grain sorghum, corn, wheat, and tall fescue. Spring flooding can delay planting in some years. Measures that maintain tilth and increase the content of organic matter are needed. Examples are keeping tillage at a minimum and leaving crop residue on the surface.

This soil is well suited to trees. A few areas are used as native woodland. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed. Adequate site preparation, controlled burning, spraying, and cutting or girdling control plant competition. No hazards or limitations affect planting or harvesting. Important species include black walnut, northern red oak, bur oak, eastern cottonwood, pecan, and green ash.

This soil generally is unsuited to building site development because of the hazard of flooding. Overcoming this hazard is difficult without major flood-control measures.

The land capability classification is IIw.

Wa—Waben cherty silt loam, 2 to 5 percent slopes. This deep, moderately sloping, well drained soil is on terraces and the lower side slopes. Individual areas are irregular in shape and range from 10 to 40 acres in size.

Typically, the surface layer is dark brown cherty silt loam about 10 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is dark yellowish brown, friable cherty silt loam, and the lower part is yellowish red, firm very cherty silty clay loam.

Included with this soil in mapping are small areas of Clarksville and Nixa soils. These very cherty soils are on the steeper side slopes. They make up 5 to 10 percent of the map unit.

Permeability is moderately rapid in the Waben soil, and available water capacity is moderate. Surface runoff is medium. Tilth is fair. The surface layer generally is slightly acid but is more acid in areas that have not been limed.

Most areas are used for cultivated crops. A few are used as tame grass pasture or hayland or as woodland. This soil is moderately well suited to grain sorghum, soybeans, and wheat. It is poorly suited to corn because of seasonal droughtiness. The chert fragments in the surface layer interfere with tillage. Erosion is a hazard if cultivated crops are grown. Contour farming, diversions and terraces, grassed waterways, and minimum tillage help to prevent excessive soil loss. Deep cuts that are made when terraces are constructed can expose the very cherty subsoil. Returning crop residue to the soil improves tilth and fertility. Crop rotation helps to control weeds, plant diseases, and insect carryover.

This soil is well suited to tame grasses for hay or pasture. Proper stocking rates, pasture rotation, timely deferment of haying or grazing, and restricted use during wet periods help to keep the pasture or hayland in good condition. Applications of fertilizer increase the production of tame grasses.

This soil is suited to trees. Removal of undesirable trees, measures that protect the woodland from fire, and controlled grazing improve the quality of the timber and the growth rate. Seedling mortality is moderate. Planting special stock of a larger size than is typical or planting containerized stock helps to achieve better survival. Important species are black walnut, pin oak, bur oak, pecan, and green ash.

This soil is well suited to dwellings, local roads and streets, and septic tank absorption fields. It is poorly suited to sewage lagoons because of seepage. Sealing the lagoon helps to control seepage.

The land capability classification is IIIs.

Za—Zaar silty clay, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on foot slopes in the uplands. Individual areas are long and narrow or irregularly shaped and range from 20 to 200 acres in size.

Typically, the surface layer is black silty clay about 8 inches thick. The subsurface layer is black, firm silty clay about 7 inches thick. The subsoil is mottled, very firm silty clay about 37 inches thick. The upper part is black, and the lower part is dark brown. The substratum to a depth of about 60 inches is dark gray and yellowish brown silty clay. In some areas shale is within a depth of 40 inches.

Included with this soil in mapping are small areas of Hepler and Parsons soils. The silty Hepler soils are on narrow flood plains that are channeled. Parsons soils have a silty surface layer. They are on broad flats. Included soils make up 5 to 15 percent of the map unit.

Permeability is very slow in the Zaar soil, and available water capacity is high. Surface runoff is slow. Tilth is poor. The shrink-swell potential is high. Cracks are common during dry periods. A perched seasonal high water table is at a depth of 1 to 2 feet. The topsoil is slightly acid.

Most areas are used for cultivated crops. A few are used as tame grass pasture. This soil is well suited to alfalfa, soybeans, grain sorghum, corn, wheat, and tall fescue. The wetness, however, can damage crops and delay tillage. Also, the crops are adversely affected during dry periods because the clayey subsoil fails to release water readily to plants. A bedding system and drainage ditches reduce the wetness. Measures that improve tilth and increase the content of organic matter are needed. Keeping tillage at a minimum, leaving crop residue on the surface, establishing grassed waterways, terracing, and farming on the contour help to prevent excessive soil loss, improve tilth, and increase the content of organic matter.

This soil is well suited to tame grass pasture and native range. Overgrazing, however, reduces the vigor and retards the growth of the grasses. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition. Applications of fertilizer, proper stocking rates, rotation grazing, and a timely season of use increase forage production in the areas used as tame grass pasture. Grazing when the soil is wet or overgrazing causes surface compaction and poor tilth, reduces the extent of the grasses, and increases the extent of weeds.

This soil is moderately well suited to dwellings and local roads and streets. The wetness and the shrink-swell potential are limitations on sites for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material help to prevent the structural damage caused by wetness and by shrinking and swelling. Low strength and the shrink-swell potential are limitations on sites for local roads and streets. The roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to prevent the road damage caused by shrinking and swelling.

This soil is well suited to sewage lagoons. Because of the very slow permeability, however, it generally is unsuitable as a septic tank absorption field.

The land capability classification is IIIw.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil economically to produce a sustained high yield of crops. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 303,000 acres in Cherokee County, or nearly 80 percent of the total acreage, meets the soil requirements for prime farmland. About 210,000 acres of this land is used for cultivated crops, mainly soybeans, wheat, and grain sorghum. Tall fescue is grown in some areas of pasture or hayland.

The map units in the survey area that are considered prime farmland are listed in this section. This list does not constitute a recommendation for a particular land

use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Because they have a seasonal high water table, the Gerald, Hepler, Lanton, and Osage soils on the following list qualify as prime farmland only in areas where this limitation has been overcome by a drainage system. Onsite evaluation is needed to determine whether or not specific areas of these soils are adequately drained. The Gerald soil generally is adequately drained because of the application of drainage measures or because of the incidental drainage that results from farming, roadbuilding, or other kinds of land development.

The map units that meet the soil requirements for prime farmland are:

Be Bates loam, 1 to 3 percent slopes
Bf Bates loam, 3 to 6 percent slopes
Br Brazilton silty clay loam, 1 to 3 percent slopes
Cd Catoosa silt loam, 0 to 2 percent slopes
Ce Cherokee silt loam, 0 to 1 percent slopes
Db Dennis silt loam, 1 to 3 percent slopes
Ge Gerald silt loam, 0 to 2 percent slopes (where drained)
He Hepler silt loam, occasionally flooded (where drained)
Ln Lanton silt loam, occasionally flooded (where drained)
Os Osage silty clay, occasionally flooded (where drained)
Pr Parsons silt loam, 0 to 2 percent slopes
Se Secesh silt loam, 0 to 2 percent slopes
To Taloka silt loam, 0 to 1 percent slopes
Vb Verdigris silt loam, occasionally flooded
Za Zaar silty clay, 0 to 2 percent slopes

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

John C. Dark, conservation agronomist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 57 percent of the acreage in Cherokee County is used for cultivated crops. During the period 1971 to 1981, soybeans were grown on about 44 percent of the cropland, wheat on 28 percent, grain sorghum on 12 percent, and corn, barley, oats, alfalfa, and other crops on 16 percent (*3*). The acreage of wheat grown during this period is about twice that of the previous 10-year period, the acreage of oats, barley, corn, and alfalfa is less, and the acreage of all other crops is about the same.

Crop production can be increased on most farms by applying the latest crop production technology. This soil survey can facilitate the application of such technology. A system of soil management is a combination of practices used to produce crops and grasses. The main concerns in managing the soils in Cherokee County are controlling erosion, maintaining or improving tilth and fertility, and draining wet areas.

Erosion is the major problem on about 55 percent of the cropland in the survey area. If the slope is more than 1 percent, erosion is a hazard. Bates, Catoosa, Dennis, Eram, Gerald, Nixa, and Zaar are arable soils that have a slope of more than 1 percent.

Loss of the surface layer through erosion is damaging because the plant nutrients that were in the surface layer are no longer available and because in most soils part of the subsoil is incorporated into the plow layer after erosion has occurred. Erosion also results in stream sedimentation. Control of erosion helps to prevent the pollution of streams and other water areas by sediment and improves water quality for all uses.

Effective erosion control can be achieved by various combinations of conservation practices. Terraces can be effective because they reduce the length of slopes. Contour farming may be beneficial if used in combination with terraces, especially on slopes of more than 2 percent. Leaving crop residue on the surface increases the rate of water infiltration, thereby decreasing the runoff rate and the susceptibility to erosion. It also

preserves the productive capacity of the soil. Using noninversion tillage tools and keeping tillage at a minimum help to keep the residue on the surface. Including wheat, oats, and barley in the cropping sequence helps to prevent excessive soil loss.

Soil tilth is the physical condition of soil, especially soil structure, as related to the growth of plants. It affects water infiltration and seedbed preparation. Soils with good tilth are granular and porous. Tilth is a major concern on all soils, particularly Osage and Zaar soils and eroded soils in which the clayey subsoil has been mixed with the surface layer. Through its effect on water infiltration, tilth affects crop production. An increased rate of water infiltration increases the amount of water available for plant growth. The amount of available water is especially important on Bates, Eram, and other arable soils underlain by bedrock that restricts root development.

Soil fertility is affected by the supply of plant nutrients and by reaction. Most of the soils in the survey area have a slightly acid or medium acid surface layer unless they have been limed. Applications of lime reduce the acidity of these soils. They can increase the production of legumes, such as alfalfa, and of other crops that are more productive on neutral soils. On all soils the amount of lime and fertilizer needed should be based on the results of soil tests, on the needs of the crop, on farmer experience, and on the expected level of yields. The Cooperative Extension Service can help to determine the kinds and amounts of nutrients needed.

Drainage of excess surface water is necessary before production of cultivated crops can be sustained on Hepler, Lanton, and Osage soils. Surface drains or a bedding system can help to remove the excess water.

Tall fescue is the main tame grass grown for pasture or hay in the county. The main concern in managing pasture or hayland is maintaining or improving the quality and quantity of forage. Applying fertilizer helps to keep the pasture or hayland in good condition. The amount and kind to be applied should be based on the results of the soil tests and on field observations. Delaying grazing or haying when the soil is wet helps to prevent surface compaction.

Proper stocking rates help to keep pastures in good condition. Rotation grazing helps to prevent depletion of the pasture by allowing the grasses to recover after periods of grazing. Providing water and salt at a variety of locations results in a uniform distribution of grazing. Mowing a pasture that has been grazed unevenly or has an excess of forage and spraying with herbicides control invading trees, brush, low-quality grasses, and broadleaf weeds.

Further information about cropland management can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

Keith A. Ticknor, forester, Soil Conservation Service, helped prepare this section.

About 33,800 acres in Cherokee County, or 9 percent of the total acreage, is forested. Lumber and black walnut veneer are the most common wood products derived from the forest land. Pecan nuts, both from cultivated orchards and from native trees, also are an important forest crop (fig. 14).

The woodland generally occurs as irregular tracts and narrow bands along streams and rivers and as strips in upland drainageways and on steep upland soils underlain by limestone or sandstone. Also, most areas that have been strip mined support a woody cover after mining is completed. The woodland is divided into three main forest cover types—post oak-blackjack oak; hackberry-American elm-green ash; and sycamore-silver maple-American elm.

The bottom land in the Hepler-Osage soil association and the upland drainageways support the hackberry-American elm-green ash and sycamore-silver maple-American elm forest cover types (fig. 15). Many species associated with these cover types are evident, including black walnut, river birch, oaks (white, bur, chinkapin, red, pin, black, and Shumard), hickories (mockernut, black, kingnut, shagbark, and bitternut), persimmon, pawpaw, sassafras, eastern cottonwood, and black willow. Some nearly pure stands of pecan are in areas of the sycamore-silver maple-American elm cover type.

The post oak-blackjack oak forest cover type is in upland areas of the Clarksville-Nixa-Tonti soil association, generally on the more cherty soils. The most common associated species are oaks, hickories, eastern redbud, sassafras, American elm, and green ash.

Many of the trees, especially the bottom land species, have commercial value for wood products. Only a small part of the woodland, however, is managed for commercial wood production. Most of wooded areas are privately owned tracts making up only a small acreage of the farms.

The acreage of forest land is declining, mainly as a result of the conversion of woodland along streams to cropland. Many of the soils in the county have good potential for Christmas trees and the trees used in the production of nuts, veneer, sawtimber, firewood, and other wood products. Most of these soils, however, are used as cropland and are unlikely to be converted to woodland. The soils on bottom land along rivers and streams produce high-value hardwoods within a short period. In contrast, the upland soils produce low-value trees over a long period.

Table 6 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each suitable soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. It is based on the site index of the species listed first in the *common trees* column. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *r* indicates steep slopes; *x*,

Figure 14.—Pecan orchard in an area of Osage silty clay, occasionally flooded.

stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted rooting depth; *c*, clay in the upper part of the soil; *s*, sandy texture; and *f*, high content of coarse fragments in the soil profile. The letter *a* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: r, x, w, t, d, c, s, and f.

In table 6, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* indicates that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is

Figure 15.—A wooded area of Hepler silt loam, frequently flooded, in an upland drainageway.

the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Windbreaks and Environmental Plantings

Keith A. Ticknor, forester, Soil Conservation Service, helped prepare this section.

Trees grow on most of the farmsteads in Cherokee County. They were planted at various times by the landowners after the farmsteads were established. They generally are environmental plantings. The number of farmstead or feedlot windbreaks is limited. Many species are grown as environmental plantings. The most common ones are pecan, black walnut, green ash, Siberian elm, and hackberry. Eastern redcedar and Siberian elm are included in most windbreaks.

Many environmental plantings and a few windbreaks are planted each year around rural homesites and around farmsteads. Tree planting is a continual need because old trees pass maturity and deterioriate, because some trees are destroyed by insects, disease, or storms, and because new plantings are needed on new homesites.

Many field windbreaks are established throughout the county. They generally are hedgerows of osageorange. They were planted as property lines and field boundaries, as fences, and as a source of wood for posts. Many of these windbreaks are being removed because fields are being enlarged.

In order for windbreaks and environmental plantings to fulfill their intended purpose, the soils on the site should be suited to the trees or shrubs selected for planting. Permeability, available water capacity, fertility, soil depth, and texture greatly affect the growth rate. The trees and shrubs can be easily established in the county. The survival rate can be restricted, however, mainly by competition from weeds and grasses. The main management needs are proper site preparation before the trees or shrubs are planted and measures that control the competing weeds and grasses after the trees or shrubs are planted.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 7 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

Robert J. Higgins, biologist, Soil Conservation Service, helped prepare this section.

Cherokee County offers some unusual recreation opportunities. Several strip-mined areas owned by the state are open to the public for hunting and fishing (fig. 16). Some of these areas have facilities for picnicking, boating, and camping. The Neosho River offers the unique opportunity of fishing for paddlefish. Many areas along Spring River and Shoal Creek, in the southeastern part of the county, are excellent sites for camping, fishing, and other recreational activities.

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil

Figure 16.—A pond in an area of Kanima soils. Ponds in areas of these soils provide opportunities for fishing.

properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or

stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

Robert J. Higgins, biologist, Soil Conservation Service, helped prepare this section.

The primary game species in Cherokee County are bobwhite quail, mourning dove, cottontail rabbit, fox squirrel, whitetail deer, and several species of waterfowl. The state-owned strip-mined areas are excellent sites for hunting and fishing.

Nongame species are numerous because of the diverse habitat types in the county. Cropland, woodland, and grassland are interspersed throughout the county. Each of these provides a habitat for a particular group of species.

Furbearers are common along the streams and in the strip-mined areas. Muskrat, raccoon, bobcat, coyote, and fox are trapped or hunted.

Stock water ponds, streams, and the strip-mined pits provide good to excellent fishing. The species commonly caught are largemouth and spotted bass, channel cat, bullhead and flathead catfish, bluegill, and crappie. Paddlefish in the Neosho River can be snagged during their spring spawning runs.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, grain sorghum, wheat, oats, and soybeans.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestems, goldenrod, switchgrass, indiangrass, beggarweed, ragweed, and native legumes.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, sycamore, cottonwood, black walnut, hackberry, mulberry, hickory, ash, and willow. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are plum, fragrant sumac, Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are eastern redcedar, pine, spruce, and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are plum, dogwood, buckbrush, gooseberry, blackberry, and sumacs.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, cattails, indigobush, prairie cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, mourning dove, meadowlark, field sparrow, and cottontail rabbit.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, owls, hawks, thrushes, woodpeckers, squirrels, opossum, raccoon, and whitetail deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include coyotes, hawks, vultures, killdeer, meadowlark, and lark bunting.

Technical assistance in planning wildlife areas and in determining the vegetation suitable for planting can be obtained from the local office of the Soil Conservation Service. Additional information and assistance can be obtained from the Kansas Fish and Game Commission and from the Cooperative Extension Service.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the

performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Sanitary Facilities

Table 11 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many

local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the

water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium.

A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 17.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The

estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet

and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days.

Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 16. Only saturated zones within a depth of about 6 feet are indicated.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 17 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Kansas Department of Transportation.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*5*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udoll (*Ud*, meaning humid, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiudolls (*Argi*, meaning argillic horizon, plus *udoll*, the suborder of the Mollisols that have a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Argiudolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, thermic Typic Argiudolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*4*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*5*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Bates Series

The Bates series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in material weathered from thinly bedded sandstone and interbedded sandy and silty shale. Slope ranges from 1 to 7 percent.

Bates soils are similar to Bolivar soils and are commonly adjacent to Collinsville and Dennis soils. Bolivar soils do not have a mollic epipedon. Collinsville soils are on the steeper side slopes. They are less than 20 inches deep over sandstone. Dennis soils have more

clay in the subsoil than the Bates soils. Also, they are lower on the landscape.

Typical pedon of Bates loam, 1 to 3 percent slopes, 2,700 feet west and 100 feet north of the southeast corner of sec. 24, T. 34 S., R. 23 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; slightly hard, friable; many fine roots; slightly acid; gradual smooth boundary.

A—8 to 13 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; slightly hard, friable; common fine roots; medium acid; gradual smooth boundary.

BA—13 to 21 inches; dark brown (10YR 3/3) loam, dark grayish brown (10YR 4/2) dry; few fine faint dark yellowish brown (10YR 4/4) mottles; moderate medium granular structure; slightly hard, friable; common fine roots; medium acid; gradual smooth boundary.

Bt—21 to 27 inches; dark brown (10YR 4/3) clay loam, brown (10YR 5/3) dry; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium and fine subangular blocky structure; hard, firm; common fine roots; thin clay films on faces of peds; about 10 percent small soft sandstone fragments; strongly acid; gradual smooth boundary.

BC—27 to 34 inches; dark brown (7.5YR 4/4) clay loam, brown (7.5YR 5/4) dry; common medium distinct yellowish brown (10YR 5/6) and few medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; hard, firm; few fine roots; few small black concretions; about 15 percent sandstone and shale fragments; strongly acid; clear wavy boundary.

Cr—34 inches; soft sandstone interbedded with sandy and silty shale.

The thickness of the solum, or the depth to bedrock, ranges from 20 to 40 inches. The mollic epipedon ranges from 8 to 24 inches in thickness. A few sandstone fragments are throughout some pedons.

The A horizon has hue of 10YR, value of 2 or 3 (3 to 5 dry), and chroma of 2 or 3. It is dominantly loam, but the range includes silt loam and fine sandy loam. This horizon is medium acid or slightly acid unless it is limed. The Bt horizon has hue of 10YR or 7.5YR, value of 3 to 5 (4 to 6 dry), and chroma of 3 to 5. It is clay loam or loam that ranges from 18 to 35 percent clay. It is strongly acid to slightly acid.

Bolivar Series

The Bolivar series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in material weathered from sandstone and sandy shale. Slope ranges from 4 to 15 percent.

Bolivar soils are similar to Bates soils and are commonly adjacent to Dennis and Hector soils. Bates soils have a mollic epipedon. Dennis soils have more clay in the subsoil than the Bolivar soils. They are on foot slopes. Hector soils are less than 20 inches deep over sandstone. They are on the upper side slopes.

Typical pedon of Bolivar fine sandy loam, in an area of Bolivar-Hector fine sandy loams, 4 to 15 percent slopes, 2,500 feet east and 400 feet north of the southwest corner of sec. 28, T. 33 S., R. 25 E.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) fine sandy loam, brown (10YR 5/3) dry; moderate fine granular structure; soft, friable; common fine roots; few worm casts; strongly acid; clear smooth boundary.

E—5 to 12 inches; brown (7.5YR 5/4) fine sandy loam, light brown (7.5YR 6/4) dry; weak fine granular structure; soft, very friable; common fine roots; few worm casts; strongly acid; clear smooth boundary.

BE—12 to 17 inches; brown (7.5YR 5/4) clay loam, light brown (7.5YR 6/4) dry; interior of some peds is strong brown (7.5YR 5/6) or reddish yellow (7.5YR 6/6) when dry; few fine faint yellowish red (5YR 4/6) mottles; moderate medium granular structure; slightly hard, friable; common fine roots; few worm casts; very strongly acid; gradual smooth boundary.

Bt—17 to 29 inches; strong brown (7.5YR 4/6) clay loam, strong brown (7.5YR 5/6) dry; common fine distinct dark red (2.5YR 3/6) mottles; moderate medium subangular blocky structure; slightly hard, friable; few fine roots; thin continuous clay films; very strongly acid; gradual smooth boundary.

BC—29 to 36 inches; strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) clay loam, reddish yellow (7.5YR 6/6) and light gray (10YR 7/2) dry; common fine prominent red (2.5YR 4/6) mottles; weak fine subangular blocky structure; slightly hard, friable; few small sandstone fragments; very strongly acid; clear smooth boundary.

Cr—36 to 46 inches; light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) thinly bedded soft sandstone and sandy shale.

R—46 inches; sandstone.

The thickness of the solum ranges from 20 to 40 inches. It is the same as the depth to soft sandstone bedrock. The depth to hard sandstone ranges from 40 to 60 inches. The content of sandstone fragments ranges from 0 to 10 percent throughout the solum.

The A horizon has hue of 10YR, value of 3 or 4 (4 or 5 dry), and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes loam. This horizon is strongly acid or medium acid. The E horizon has hue of 10YR or 7.5YR, value of 4 or 5 (5 or 6 dry), and chroma

of 3 or 4. The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5 (5 to 7 dry), and chroma of 4 to 6. It is sandy clay loam, loam, or clay loam. It ranges from very strongly acid to medium acid.

Brazilton Series

The Brazilton series consists of deep, moderately well drained, very slowly permeable soils on uplands and terraces. These soils formed in material that was excavated and then was mechanically redeposited in the same sequence of major horizons as that of the original soils. Slope ranges from 1 to 3 percent.

Brazilton soils are commonly adjacent to Osage and Parsons soils. The adjacent soils have a subsoil that is less compacted than that of the Brazilton soils. They are in areas that have not been excavated.

Typical pedon of Brazilton silty clay loam, 1 to 3 percent slopes, 1,800 feet south and 800 feet east of the northwest corner of sec. 4, T. 32 S., R. 22 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; hard, firm; common fine roots; medium acid; abrupt smooth boundary.

Bw—8 to 40 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; moderate medium blocky fragments; very hard, very firm; few fine roots; few shale fragments; medium acid; gradual smooth boundary.

2C—40 to 60 inches; dark gray (10YR 4/1) and yellowish brown (10YR 5/6) extremely shaly silty clay, gray (10YR 5/1) and brownish yellow (10YR 6/6) dry; massive; very hard, very firm; about 75 percent shale fragments; medium acid.

The A horizon has hue of 10YR, value 2 or 3 (3 to 5 dry), and chroma of 1 or 2. It is silt loam or silty clay loam. It is slightly acid or medium acid. The Bw horizon has hue of 10YR or 2.5Y, value of 3 or 4 (4 or 5 dry), and chroma of 1 or 2. It is clay or silty clay. It ranges from neutral to medium acid. The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 (5 to 7 dry), and chroma of 1 to 6. It is extremely shaly silty clay or extremely shaly silty clay loam. It ranges from moderately alkaline to strongly acid.

Catoosa Series

The Catoosa series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in material weathered from limestone. Slope ranges from 0 to 2 percent.

Catoosa soils are commonly adjacent to Shidler and Zaar soils. Shidler soils are less than 20 inches deep over limestone. They are on the steeper side slopes. Zaar soils have a clayey solum. They are on side slopes along drainageways.

Typical pedon of Catoosa silt loam, 0 to 2 percent slopes, 1,800 feet north and 150 feet east of the southwest corner of sec. 6, T. 32 S., R. 22 E.

Ap—0 to 7 inches; dark brown (7.5YR 3/2) silt loam, brown (7.5YR 4/2) dry; weak fine granular structure; slightly hard, friable; common fine roots; medium acid; clear smooth boundary.

A—7 to 12 inches; dark brown (7.5YR 3/2) silt loam, brown (7.5YR 4/2) dry; moderate medium granular structure; slightly hard, friable; common fine roots; medium acid; gradual smooth boundary.

BA—12 to 18 inches; dark reddish brown (5YR 3/3) silty clay loam, reddish brown (5YR 4/3) dry; moderate medium granular structure; hard, firm; common fine roots; slightly acid; gradual smooth boundary.

Bt—18 to 28 inches; dark reddish brown (5YR 3/4) silty clay loam, reddish brown (5YR 4/4) dry; moderate fine subangular blocky structure; very hard, firm; few fine roots; thin patchy clay films; few fine black concretions; slightly acid; abrupt wavy boundary.

R—28 inches; limestone.

The thickness of the solum, or the depth to bedrock, ranges from 20 to 40 inches. The mollic epipedon ranges from 10 to 20 inches in thickness.

The A horizon has hue of 10YR, 7.5YR, or 5YR, value of 2 or 3 (3 to 5 dry), and chroma of 2 or 3. It is slightly acid or medium acid. The Bt horizon has hue of 5YR or 2.5YR, value of 3 or 4 (moist or dry), and chroma of 3 or 4. It ranges from strongly acid to neutral.

Cherokee Series

The Cherokee series consists of deep, somewhat poorly drained, very slowly permeable soils on uplands. These soils formed in old alluvium. Slope is 0 to 1 percent.

Cherokee soils are similar to Gerald, Parsons, and Taloka soils and are commonly adjacent to Parsons soils. Gerald soils have a fragipan. Parsons and Taloka soils have a surface layer that is darker than that of the Cherokee soils. Also, Parsons soils are slightly higher on the landscape.

Typical pedon of Cherokee silt loam, 0 to 1 percent slopes, 2,000 feet east and 200 feet north of the southwest corner of sec. 28, T. 33 S., R. 22 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable; few fine roots; neutral; clear smooth boundary.

E—7 to 14 inches; grayish brown (10YR 5/2) silt loam, light brownish gray (10YR 6/2) dry; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium granular structure; slightly hard, friable; few fine roots; medium acid; abrupt wavy boundary.

Btg1—14 to 30 inches; very dark grayish brown (10YR 3/2) clay, dark grayish brown (10YR 4/2) dry; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium blocky structure; extremely hard, very firm; few fine roots; continuous clay films; medium acid; gradual smooth boundary.

Btg2—30 to 36 inches; dark grayish brown (10YR 4/2) clay, grayish brown (10YR 5/2) dry; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium blocky structure; extremely hard, very firm; few fine roots; continuous clay films; medium acid; gradual smooth boundary.

BCg—36 to 47 inches; grayish brown (10YR 5/2) clay, light brownish gray (10YR 6/2) dry; common medium prominent yellowish red (5YR 5/6) mottles; weak medium blocky structure; extremely hard, very firm; thin patchy clay films; medium acid; gradual wavy boundary.

Cg—47 to 60 inches; grayish brown (10YR 5/2) silty clay loam, light brownish gray (10YR 6/2) dry; few medium distinct yellowish brown (10YR 5/6) mottles; massive; extremely hard, very firm; strongly acid.

The thickness of the solum ranges from 40 to 58 inches. The A horizon has hue of 10YR, value of 3 to 5 (4 to 6 dry), and chroma of 1 or 2. The E horizon has hue of 10YR, value of 5 to 7 (6 to 8 dry), and chroma of 1 or 2. The Bt horizon has hue of 10YR or 2.5Y, value of 3 to 5 (4 to 6 dry), and chroma of 1 or 2. It is strongly acid or medium acid. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5 (5 or 6 dry), and chroma of 1 or 2. It is silty clay loam, silty clay, or clay. It ranges from very strongly acid to neutral.

Clarksville Series

The Clarksville series consists of deep, somewhat excessively drained, moderately rapidly permeable soils on uplands. These soils formed in cherty limestone residuum. Slope ranges from 10 to 30 percent.

Clarksville soils are commonly adjacent to Nixa and Waben soils. The moderately well drained Nixa soils are on side slopes above the Clarksville soils. They have a fragipan. Waben soils are less acid in the subsoil than the Clarksville soils. Also, they are lower on the landscape.

Typical pedon of Clarksville very cherty silt loam, 10 to 30 percent slopes, 800 feet south and 100 feet west of the northeast corner of sec. 8, T. 35 S., R. 25 E.

A—0 to 4 inches; dark grayish brown (10YR 4/2) very cherty silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; slightly hard, friable; common fine and medium roots; about 45 percent angular chert fragments; strongly acid; abrupt smooth boundary.

E—4 to 23 inches; brown (10YR 4/3) very cherty silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; slightly hard, friable; common fine roots; about 45 percent angular chert fragments; very strongly acid; clear wavy boundary.

Bt1—23 to 32 inches; dark brown (7.5YR 4/4) very cherty silty clay loam, light brown (7.5YR 6/4) dry; moderate fine subangular blocky structure; hard, firm; common fine roots; about 55 percent angular chert fragments; very strongly acid; gradual smooth boundary.

Bt2—32 to 46 inches; yellowish red (5YR 4/6) extremely cherty silty clay loam, yellowish red (5YR 5/6) dry; moderate fine blocky structure; hard, firm; common fine roots; thin continuous clay films; about 70 percent angular chert fragments; very strongly acid; gradual smooth boundary.

Bt3—46 to 60 inches; yellowish red (5YR 4/6) extremely cherty silty clay loam, yellowish red (5YR 5/6) dry; moderate fine blocky structure; hard, firm; few fine roots; thin patchy clay films; about 80 percent angular chert fragments; very strongly acid.

The A horizon has hue of 10YR, value of 2 to 6 (3 to 7 dry), and chroma of 1 to 3. It ranges from medium acid to extremely acid. The E horizon has hue of 10YR, value of 4 to 7 (5 to 8 dry), and chroma of 2 or 3. The Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5 (5 or 6 dry), and chroma of 4 to 6. It is very cherty silty clay loam, very cherty silty clay, extremely cherty silty clay, or extremely cherty silty clay loam.

Collinsville Series

The Collinsville series consists of shallow, well drained, moderately rapidly permeable soils on uplands. These soils formed in material weathered from sandstone. Slope ranges from 4 to 15 percent.

Collinsville soils are similar to Hector and Shidler soils and are commonly adjacent to Bates and Dennis soils. Hector soils do not have a mollic epipedon. Shidler soils are shallow over limestone. Bates and Dennis soils are more than 20 inches deep over bedrock and have an argillic horizon. They generally are less sloping than the Collinsville soils and in similar positions on the landscape.

Typical pedon of Collinsville fine sandy loam, in an area of Bates-Collinsville complex, 4 to 15 percent slopes, 200 feet north and 100 feet east of the southwest corner of sec. 14, T. 33 S., R. 24 E.

A1—0 to 9 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; slightly hard, friable; many fine roots; medium acid; gradual wavy boundary.

A2—9 to 14 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; slightly hard, friable;

many fine roots; about 15 percent sandstone fragments 1/4 inch to 3 inches in diameter; slightly acid; gradual wavy boundary.

R—14 inches; sandstone.

The thickness of the solum, or the depth to sandstone bedrock, ranges from 4 to 20 inches. Reaction ranges from slightly acid to strongly acid throughout the profile.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 (3 to 5 dry), and chroma of 2 or 3. It is loam or fine sandy loam.

Dennis Series

The Dennis series consists of deep, moderately well drained, slowly permeable soils on uplands. These soils formed in material weathered from shale. Slope ranges from 1 to 3 percent.

Dennis soils are commonly adjacent to Bates, Collinsville, Parsons, and Taloka soils. Bates and Collinsville soils are less than 40 inches deep over sandstone. They generally are on side slopes above the Dennis soils. Parsons and Taloka soils have an E horizon and do not have a BA horizon. They are in the less sloping areas.

Typical pedon of Dennis silt loam, 1 to 3 percent slopes, 1,000 feet east and 500 feet south of the northwest corner of sec. 5, T. 32 S., R. 22 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable; many fine roots; medium acid; clear smooth boundary.

A—7 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; few fine brown (10YR 4/3) silt coatings on faces of peds; moderate medium and fine granular structure; slightly hard, friable; many fine roots; medium acid; gradual smooth boundary.

BA—11 to 19 inches; dark brown (10YR 3/3) silty clay loam, dark brown (10YR 4/3) dry; common fine distinct yellowish brown (10YR 5/6) and common fine prominent reddish brown (5YR 4/4) mottles; moderate medium and fine subangular blocky structure; slightly hard, friable; many fine roots; few worm casts; gray silt grains on faces of peds in the upper 2 inches; strongly acid; gradual smooth boundary.

Bt1—19 to 29 inches; dark brown (10YR 4/3) silty clay, brown (10YR 5/3) dry; common medium distinct dark grayish brown (2.5Y 4/2) and many medium prominent yellowish red (5YR 4/6) mottles; moderate medium and fine blocky structure; very hard, firm; many fine roots; clay films on faces of most peds; few black stains and masses; slightly acid; gradual smooth boundary.

Bt2—29 to 37 inches; brown (7.5YR 5/4) silty clay, light brown (7.5YR 6/4) dry; many coarse prominent yellowish red (5YR 5/6) and few fine prominent dark grayish brown (2.5Y 4/2) mottles; moderate medium blocky structure; very hard, very firm; few fine roots; clay films on faces of peds; few fine soft black accumulations; slightly acid; gradual smooth boundary.

Bt3—37 to 46 inches; gray (10YR 5/1) and strong brown (7.5YR 5/6) silty clay, gray (10YR 6/1) and reddish yellow (7.5YR 6/6) dry; moderate medium blocky structure; very hard, very firm; slightly acid; gradual smooth boundary.

BC—46 to 60 inches; strong brown (7.5YR 5/6) and gray (10YR 6/1) silty clay loam, reddish yellow (7.5YR 6/6) and light gray (10YR 7/1) dry; weak medium subangular blocky structure; very hard, firm; mildly alkaline.

The solum is more than 60 inches thick. The mollic epipedon ranges from 10 to 20 inches in thickness.

The A horizon has hue of 10YR, value of 2 or 3 (3 to 5 dry), and chroma of 2 or 3. It is medium acid or strongly acid. The BA horizon has hue of 10YR or 7.5YR, value of 3 or 4 (4 or 5 dry), and chroma of 3 or 4. It ranges from medium acid to very strongly acid. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5 (5 or 6 dry), and chroma of 3 to 6. It ranges from slightly acid to strongly acid. It is silty clay or silty clay loam.

Eram Series

The Eram series consists of moderately deep, moderately well drained, slowly permeable soils on uplands. These soils formed in material weathered from shale. Slope ranges from 3 to 12 percent.

Eram soils are commonly adjacent to Shidler and Zaar soils. Zaar soils are more than 40 inches deep over bedrock. They are lower on the landscape than the Eram soils. Shidler soils are shallow over limestone. They are higher on the landscape than the Eram soils.

Typical pedon of Eram silty clay loam, 3 to 7 percent slopes, 1,800 feet south and 200 feet west of the northeast corner of sec. 19, T. 31 S., R. 23 E.

A—0 to 11 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; hard, firm; common fine roots; slightly acid; gradual wavy boundary.

Bt—11 to 21 inches; dark grayish brown (10YR 4/2) silty clay, grayish brown (10YR 5/2) dry; common fine prominent yellowish red (5YR 4/6) mottles; moderate fine blocky structure; very hard, very firm; common fine roots; thin patchy clay films; about 5 percent fine shale fragments; medium acid; gradual smooth boundary.

BC—21 to 32 inches; brown (10YR 5/3) silty clay, light brownish gray (10YR 6/2) dry; common fine distinct

yellowish brown (10YR 5/6) and few medium distinct dark gray (10YR 4/1) mottles; weak fine subangular blocky structure; very hard, very firm; few fine roots; about 10 percent shale fragments; slightly acid; gradual smooth boundary.

Cr—32 inches; light olive brown (2.5Y 5/4) soft shale.

The thickness of the solum, or the depth to shale, ranges from 20 to 40 inches. The mollic epipedon ranges from 8 to 20 inches in thickness.

The A horizon has hue of 10YR, value of 2 or 3 (3 or 4 dry), and chroma of 2 or 3. It is dominantly silty clay loam, but the range includes silt loam. This horizon is slightly acid or medium acid. The Bt horizon has hue of 10YR, value of 3 to 5 (4 to 6 dry), and chroma of 2 or 3. It ranges from strongly acid to neutral.

Gerald Series

The Gerald series consists of deep, somewhat poorly drained soils on uplands. These soils formed in a thin mantle of loess and in the underlying material weathered from cherty limestone. Permeability is moderate in the upper part of the profile and very slow in the lower part. Slope ranges from 0 to 2 percent.

Gerald soils are similar to Parsons and Cherokee soils and are commonly adjacent to Nixa and Tonti soils. Parsons and Cherokee soils do not have a fragipan and have no chert fragments in the lower part of the subsoil. Nixa and Tonti soils are lighter colored in the surface layer than the Gerald soils and have more chert in the upper horizons. They are on the lower side slopes.

Typical pedon of Gerald silt loam, 0 to 2 percent slopes, 2,500 feet south and 150 feet east of the northwest corner of sec. 11, T. 35 S., R. 25 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; slightly hard, friable; common fine roots; less than 5 percent chert fragments; very strongly acid; abrupt smooth boundary.

E—8 to 13 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; few fine faint brown (10YR 5/3) mottles; weak fine granular structure; slightly hard, friable; common fine roots; less than 5 percent chert fragments; very strongly acid; abrupt smooth boundary.

Bt1—13 to 17 inches; dark brown (7.5YR 3/2) silty clay, dark brown (7.5YR 4/2) dry; common fine distinct reddish brown (5YR 4/4) mottles; moderate fine blocky structure; very hard, firm; common fine roots; thin continuous clay films; less than 5 percent chert fragments; very strongly acid; gradual wavy boundary.

Bt2—17 to 22 inches; dark brown (7.5YR 4/2) silty clay, brown (7.5YR 5/2) dry; common fine and medium distinct red (2.5YR 4/6) mottles; moderate fine blocky structure; very hard, firm; few fine roots; thin continuous brown and dark brown clay films; less than 5 percent chert fragments; very strongly acid; clear wavy boundary.

2Bx1—22 to 30 inches; dark brown (7.5YR 4/4), brown (7.5YR 5/4), and strong brown (7.5YR 5/6) silty clay loam, brown (7.5YR 5/4) and reddish yellow (7.5YR 6/6) dry; massive; firm; brittle; about 10 percent chert fragments; very strongly acid; clear wavy boundary.

2Bx2—30 to 42 inches; yellowish red (5YR 4/6) and light reddish brown (5YR 6/3) very cherty silty clay loam, yellowish red (5YR 5/6) and pink (5YR 7/3) dry; few fine distinct dark gray (10YR 4/1) mottles; massive; very firm; brittle; 45 to 50 percent chert fragments; very strongly acid; clear smooth boundary.

2Bt—42 to 60 inches; yellowish red (5YR 4/6) extremely cherty silty clay, yellowish red (5YR 5/6) dry; few medium distinct dark grayish brown (10YR 4/2) and light brown (7.5YR 6/4) mottles; weak fine blocky structure; very firm; thin patchy clay films; 60 to 70 percent chert fragments; very strongly acid.

The solum is more than 60 inches thick. The content of chert fragments ranges from less than 5 percent to 10 percent above the fragipan. Reaction is strongly acid or very strongly acid throughout the profile.

The A horizon has hue of 10YR, value of 2 or 3 (3 to 5 dry), and chroma of 1 or 2. The E horizon has hue of 10YR, value of 4 to 6 (5 to 7 dry), and chroma of 1 or 2. The Bt horizon has hue of 10YR or 7.5YR, value of 2 to 5 (3 to 6 dry), and chroma of 1 or 2. The Bx horizon has colors similar to those of the Bt horizon and is mottled with shades of red, gray, and brown.

Hector Series

The Hector series consists of shallow, well drained, moderately rapidly permeable soils on uplands. These soils formed in material weathered from sandstone. Slope ranges from 4 to 15 percent.

Hector soils are similar to Collinsville soils and are commonly adjacent to Bolivar soils. Bolivar soils are 20 to 40 inches deep over sandstone. They are on the upper side slopes. Collinsville soils have a mollic epipedon.

Typical pedon of Hector fine sandy loam, in an area of Bolivar-Hector fine sandy loams, 4 to 15 percent slopes, 800 feet south and 300 feet east of the northwest corner of sec. 14, T. 33 S., R. 25 E.

A—0 to 3 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; weak fine granular structure; slightly hard, very friable; medium acid; clear smooth boundary.

E—3 to 7 inches; brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; weak fine granular

structure; soft, very friable; medium acid; clear smooth boundary.

Bw—7 to 15 inches; reddish brown (5YR 4/4) fine sandy loam, light reddish brown (5YR 6/4) dry; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable; about 10 percent sandstone fragments; very strongly acid; abrupt irregular boundary.

R—15 inches; sandstone.

The thickness of the solum, or the depth to bedrock, ranges from 10 to 20 inches. The solum is fine sandy loam or loam.

The A horizon has hue of 10YR, value of 3 or 4 (4 or 5 dry), and chroma of 2 or 3. It ranges from strongly acid to slightly acid. The E horizon has hue of 10YR, value of 4 or 5 (5 or 6 dry), and chroma of 2 to 4. The Bw horizon has hue of 5YR to 10YR, value of 4 or 5 (5 or 6 dry), and chroma of 4 to 6. It is very strongly acid or strongly acid. The content of sandstone fragments in this horizon ranges from 0 to 15 percent.

Hepler Series

The Hepler series consists of deep, somewhat poorly drained, moderately slowly permeable soils on low stream terraces and flood plains. These soils form in silty alluvial sediments. Slope ranges from 0 to 2 percent.

Hepler soils are similar to Lanton and Verdigris soils and are commonly adjacent to Lanton, Osage, Secesh, and Verdigris soils. Lanton and Verdigris soils have a mollic epipedon. Osage soils have a clayey subsoil. They are in concave areas on the flood plains. Secesh soils have a cherty subsoil. They are on the higher stream terraces.

Typical pedon of Hepler silt loam, occasionally flooded, 400 feet south and 200 feet west of the northeast corner of sec. 6, T. 34 S., R. 22 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; slightly hard, friable; slightly acid; clear smooth boundary.

E1—7 to 12 inches; dark brown (10YR 4/3) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; hard, friable; very strongly acid; gradual smooth boundary.

E2—12 to 23 inches; brown (10YR 5/3) silt loam, light gray (10YR 7/2) dry; few fine faint dark brown (10YR 3/3) mottles; weak fine and medium granular structure; hard, friable; very strongly acid; clear smooth boundary.

Bt1—23 to 33 inches; dark grayish brown (10YR 4/2) silty clay loam, grayish brown (10YR 5/2) dry; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; very hard, firm; few fine black concretions; thin patchy clay films; very strongly acid; clear smooth boundary.

Bt2—33 to 38 inches; grayish brown (10YR 5/2) silty clay loam, light brownish gray (10YR 6/2) dry; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; very hard, firm; thin patchy clay films; few fine black concretions; very strongly acid; gradual smooth boundary.

BC—38 to 60 inches; grayish brown (10YR 5/2) silty clay loam, light brownish gray (10YR 6/2) dry; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very hard, firm; few fine black concretions; very strongly acid.

The thickness of the solum ranges from 40 to more than 60 inches. The A horizon has hue of 10YR, value of 2 or 3 (3 to 5 dry), and chroma of 1 or 2. It ranges from slightly acid to strongly acid. The E horizon has hue of 10YR or 2.5Y, value of 4 or 5 (5 to 7 dry), and chroma of 2 or 3. It ranges from medium acid to very strongly acid. The Bt horizon has hue of 10YR or 2.5Y, value of 3 to 5 (5 to 7 dry), and chroma of 1 or 2. It ranges from slightly acid to very strongly acid.

Kanima Series

The Kanima series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in excavated material. Slope ranges from 3 to 50 percent.

Kanima soils are commonly adjacent to Cherokee, Dennis, and Parsons soils. The adjacent soils generally have a clayey subsoil. They are in undisturbed areas.

Typical pedon of Kanima shaly silty clay loam, 15 to 50 percent slopes, 2,000 feet south and 2,500 feet west of the northeast corner of sec. 27, T. 32 S., R. 22 E.

A—0 to 6 inches; very dark grayish brown (10YR 3/2) shaly silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; slightly hard, friable; common fine roots; neutral; gradual smooth boundary.

C—6 to 60 inches; dark brown (10YR 4/3) extremely shaly silty clay loam, grayish brown (10YR 5/2) dry; massive; slightly hard, friable; few fine roots in the upper 12 inches; about 75 percent shale fragments; few fine coal fragments; mildly alkaline.

Reaction ranges from medium acid to moderately alkaline throughout the profile. The A horizon has hue of 10YR, value of 3 to 5 (4 to 6 dry), and chroma of 2 or 3. It is shaly silty clay loam, shaly silt loam, or very shaly silty clay loam. The C horizon has hue of 10YR, 2.5Y, or 5Y, value 4 or 5 (4 to 6 dry), and chroma of 2 to 4.

Lanton Series

The Lanton series consists of deep, somewhat poorly drained, moderately slowly permeable soils on flood plains. These soils formed in alluvium. Slope ranges from 0 to 2 percent.

Lanton soils are similar to Hepler and Verdigris soils and are commonly adjacent to Hepler, Osage, and Verdigris soils. Hepler soils have an argillic horizon. Verdigris soils are moderately well drained. Osage soils have a clayey subsoil. They are in concave areas on the flood plains.

Typical pedon of Lanton silt loam, occasionally flooded, 600 feet east and 300 feet south of the northwest corner of sec. 33, T. 34 S., R. 22 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; slightly hard, friable; many fine roots; slightly acid; clear smooth boundary.

A1—7 to 16 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; slightly hard, friable; common fine roots; slightly acid; gradual smooth boundary.

A2—16 to 21 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; few fine faint gray (10YR 5/1) and dark brown (10YR 4/3) mottles; moderate medium granular structure; slightly hard, friable; few fine roots; slightly acid; gradual smooth boundary.

A3—21 to 39 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; few fine faint dark brown (10YR 3/3) and very dark gray (10YR 3/1) mottles; moderate medium granular structure; hard, firm; few fine roots; slightly acid; gradual smooth boundary.

Cg—39 to 60 inches; gray (10YR 5/1) clay, gray (10YR 5/1) dry; common medium prominent yellowish brown (10YR 5/6) mottles; massive; extremely hard, firm; few black coatings and fine concretions; neutral.

The solum is more than 24 inches thick. Reaction is neutral or slightly acid throughout the profile.

The A horizon has hue of 10YR, value of 2 or 3 (3 to 5 dry), and chroma of 1 or 2. It is silt loam or silty clay loam. The Cg horizon has hue of 10YR, value of 4 or 5 (moist or dry), and chroma of 1 or 2 and is commonly mottled with shades of yellow, brown, and gray. It is silty clay loam or clay.

Nixa Series

The Nixa series consists of deep, moderately well drained, very slowly permeable soils on uplands. These soils formed in cherty limestone residuum (fig. 17). Slope ranges from 2 to 9 percent.

Figure 17.—Profile of Nixa soils. These soils have many chert fragments. Depth is marked in feet.

Nixa soils are commonly adjacent to Clarksville, Gerald, and Tonti soils. Clarksville soils do not have a fragipan. Gerald and Tonti soils have more clay in the subsoil and less chert in the surface layer than the Nixa soils. Gerald soils are on ridgetops, and Tonti soils are on the upper side slopes above the Nixa soils.

Typical pedon of Nixa cherty silt loam, 2 to 9 percent slopes, 500 feet south and 300 feet west of the northeast corner of sec. 17, T. 35 S., R. 25 E.

A—0 to 5 inches; dark grayish brown (10YR 4/2) cherty silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable; common fine and medium roots; about 30 percent chert fragments; strongly acid; clear smooth boundary.

E—5 to 13 inches; brown (10YR 5/3) very cherty silt loam, very pale brown (10YR 7/3) dry; weak fine granular structure; slightly hard, friable; common fine and medium roots; about 45 percent chert fragments; very strongly acid; clear smooth boundary.

BE—13 to 18 inches; brown (10YR 5/3) very cherty silt loam, white (10YR 8/2) dry; weak medium granular structure; slightly hard, friable; common fine roots; about 50 percent chert fragments; very strongly acid; clear wavy boundary.

Bx—18 to 28 inches; yellowish brown (10YR 5/4) extremely cherty silt loam, very pale brown (10YR 8/3) dry; common medium prominent light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; few to no roots; about 70 percent chert fragments; firm; slightly brittle; very strongly acid; clear wavy boundary.

Bt1—28 to 42 inches; mottled red (2.5YR 4/6), yellowish brown (10YR 5/6), and light brownish gray (10YR 6/2) extremely cherty silty clay loam; moderate medium subangular blocky structure; hard, firm; thin patchy clay films; about 70 percent chert fragments; very strongly acid; gradual wavy boundary.

Bt2—42 to 60 inches; mottled yellowish red (5YR 4/6) and pinkish gray (5YR 6/2) extremely cherty silty clay loam; moderate fine blocky structure; hard, firm; thin patchy clay films; about 75 percent chert fragments; very strongly acid.

The solum is more than 60 inches thick. It is strongly acid or very strongly acid.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2. The E horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. The Bx horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 6. The Bt horizon has hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 4 to 6. The Bx and Bt horizons are mottled with shades of brown, gray, and red.

Osage Series

The Osage series consists of deep, poorly drained, very slowly permeable soils on flood plains. These soils formed in clayey alluvium. Slope ranges from 0 to 2 percent.

Osage soils are similar to Zaar soils and are commonly adjacent to Hepler, Lanton, and Verdigris soils. The somewhat poorly drained Zaar soils are on uplands. Hepler, Lanton, and Verdigris soils have less clay in the solum than the Osage soils. Hepler and Lanton soils are in positions on the landscape similar to those of the Osage soils. Verdigris soils are closer to stream channels than the Osage soils.

Typical pedon of Osage silty clay, occasionally flooded, 1,500 feet north and 390 feet east of the southwest corner of sec. 6, T. 35 S., R. 22 E.

Ap—0 to 6 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; weak medium granular structure; hard, firm; many fine roots; neutral; clear smooth boundary.

A1—6 to 12 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; moderate medium granular structure; very hard, very firm; many fine roots; slightly acid; gradual smooth boundary.

A2—12 to 17 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; few fine faint dark grayish brown (2.5Y 4/2) mottles; moderate medium blocky structure; very hard, very firm; many fine roots; medium acid; gradual smooth boundary.

Bg1—17 to 28 inches; very dark gray (5Y 3/1) clay, gra (5Y 5/1) dry; common fine distinct dark yellowish brown (10YR 4/4) and common fine faint dark grayish brown (2.5Y 4/2) mottles; moderate medium blocky structure; extremely hard, extremely firm; few fine roots; few fine black concretions; few slickensides; medium acid; gradual smooth boundary.

Bg2—28 to 41 inches; dark gray (5Y 4/1) clay, gray (5Y 5/1) dry; common medium distinct dark grayish brown (10YR 4/2) mottles; moderate medium blocky structure; extremely hard, extremely firm; common fine black concretions; common slickensides; medium acid; diffuse smooth boundary.

BCg—41 to 60 inches; dark gray (5Y 4/1) clay, gray (5Y 5/1) dry; few medium distinct olive brown (2.5Y 4/4) mottles; weak medium blocky structure; extremely hard, extremely firm; common fine black concretions; few slickensides; slightly acid.

The solum is more than 40 inches thick. The A horizon has hue of 10YR or 2.5Y, value of 2 or 3 (3 or 4 dry), and chroma of 1 or 2. It is dominantly silty clay, but the range includes silty clay loam. This horizon ranges from strongly acid to neutral. The Bg horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 or 4 (4 or 5 dry), and chroma of less than 2. It ranges from medium acid to neutral.

Parsons Series

The Parsons series consists of deep, somewhat poorly drained, very slowly permeable soils on uplands. These soils formed in old alluvium that in some areas is

mantled with a thin layer of loess. Slope ranges from 0 to 2 percent.

Parsons soils are similar to Cherokee, Gerald, and Taloka soils and are commonly adjacent to Cherokee, Dennis, and Zaar soils. Cherokee soils are lighter colored in the surface layer than the Parsons soils. Gerald soils have a fragipan and contain chert fragments in the lower part of the subsoil. Taloka soils have a surface soil that is more than than 16 inches thick. Dennis soils have a BA horizon. They are on side slopes. Zaar soils have more clay in the surface layer than the Parsons soils and do not have an E horizon. They are on the higher side slopes or in convex areas and swales.

Typical pedon of Parsons silt loam, 0 to 2 percent slopes (fig. 18), 2,550 feet north and 400 feet west of the southeast corner of sec. 34, T. 32 S., R. 23 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable; many fine roots; slightly acid; clear smooth boundary.

E—8 to 14 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium granular structure; slightly hard, friable; common fine roots; slightly acid; abrupt smooth boundary.

Btg1—14 to 25 inches; very dark grayish brown (10YR 3/2) clay, dark grayish brown (10YR 4/2) dry; many medium distinct dark brown (7.5YR 4/4) and few fine faint gray (10YR 5/1) mottles; moderate medium and fine blocky structure; extremely hard, very firm; common fine roots; thin clay films on faces of peds; medium acid; gradual smooth boundary.

Btg2—25 to 31 inches; dark grayish brown (10YR 4/2) clay, grayish brown (10YR 5/2) dry; many fine and medium distinct yellowish brown (10YR 5/6) and few fine faint gray (10YR 5/1) mottles; moderate medium blocky structure; extremely hard, very firm; few fine roots; thin clay films on faces of peds; few fine black concretions; medium acid; gradual smooth boundary.

Btg3—31 to 41 inches; gray (10YR 5/1) and yellowish brown (10YR 5/6) silty clay, gray (10YR 6/1) and brownish yellow (10YR 6/6) dry; moderate medium blocky structure; extremely hard, very firm; thin patchy clay films; few fine black concretions; a few vertical cracks filled with darker material; slightly acid; gradual smooth boundary.

BC—41 to 60 inches; gray (10YR 6/1) and yellowish red (5YR 5/6) silty clay, light gray (10YR 7/1) and reddish yellow (5YR 6/6) dry; weak coarse blocky structure; very hard, very firm; common fine and medium black concretions; neutral.

The solum ranges from 40 to more than 60 inches in thickness. It ranges from strongly acid to neutral.

Figure 18.—Profile of Parsons soils. A light colored subsurface layer overlies the Bt horizon. Depth is marked in feet.

The A horizon has hue of 10YR, value of 3 or 4 (4 or 5 dry), and chroma of 2. The E horizon has hue of 10YR,

value of 4 or 5 (5 to 7 dry), and chroma of 1 or 2. The Bt horizon has hue of 10YR or 2.5Y, value of 3 to 5 (4 to 7 dry), and chroma of 1 or 2. It is mottled with shades of gray, brown, or red. It is silty clay loam, silty clay, or clay.

Secesh Series

The Secesh series consists of deep, well drained, moderately permeable soils on stream terraces. These soils formed in silty material and in the underlying cherty residuum. Slope is 0 to 1 percent.

Secesh soils are similar to Waben soils and are commonly adjacent to Waben and Hepler soils. Waben soils have a cherty surface layer. The somewhat poorly drained Hepler soils are on the lower stream terraces. They do not have chert fragments in the subsoil.

Typical pedon of Secesh silt loam, 500 feet south and 250 feet east of the northwest corner of sec. 17, T. 35 S., R. 25 E.

Ap—0 to 10 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak medium granular structure; slightly hard, friable; common fine roots; slightly acid; clear smooth boundary.

BA—10 to 16 inches; dark brown (10YR 4/3) silty clay loam, brown (10YR 5/3) dry; moderate medium granular structure; slightly hard, friable; common fine roots; few worm casts; about 5 percent chert fragments; slightly acid; gradual smooth boundary.

Bt1—16 to 25 inches; reddish brown (5YR 4/4) silty clay loam, light reddish brown (5YR 6/4) dry; moderate medium subangular blocky structure; hard, firm; few fine roots; thin patchy clay films; about 5 percent chert fragments; strongly acid; clear wavy boundary.

2Bt2—25 to 43 inches; reddish brown (5YR 4/4) very cherty silty clay loam, light reddish brown (5YR 6/4) dry; moderate medium subangular blocky structure; hard, firm; about 55 percent chert fragments; strongly acid; gradual smooth boundary.

2Bt3—43 to 60 inches; reddish brown (5YR 4/4) extremely cherty clay loam, light reddish brown (5YR 6/4) dry; weak fine subangular blocky structure; slightly hard, friable; about 70 percent chert fragments; strongly acid.

The thickness of the solum ranges from 30 to more than 60 inches. The A horizon has hue of 10YR, value of 2 or 3 (4 or 5 dry), and chroma of 2 or 3. The Bt and 2Bt horizons have hue of 10YR to 5YR, value of 4 or 5 (5 or 6 dry), and chroma of 4 to 6. They are medium acid or strongly acid. The content of chert in the 2Bt horizon ranges from 35 to 80 percent.

Shidler Series

The Shidler series consists of shallow, well drained, moderately permeable soils on uplands. These soils formed in material weathered from limestone. Slope ranges from 4 to 8 percent.

Shidler soils are similar to Collinsville soils and are commonly adjacent to Catoosa and Eram soils. Collinsville soils are shallow over sandstone. Catoosa and Eram soils are 20 to 40 inches deep over bedrock. Catoosa soils are on ridgetops, and Eram soils are on the lower side slopes.

Typical pedon of Shidler silty clay loam, in an area of Eram-Shidler silty clay loams, 4 to 12 percent slopes, 2,150 feet south and 300 feet west of the northeast corner of sec. 19, T. 31 S., R. 23 E.

A—0 to 12 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; strong medium granular structure; slightly hard, friable; many fine roots; about 10 percent flat limestone fragments on the surface and throughout the horizon; neutral; abrupt irregular boundary.

R—12 inches; hard limestone.

The thickness of the solum, or the depth to limestone, ranges from 4 to 20 inches. The A horizon has hue of 5YR, 7.5YR, or 10YR, value of 2 or 3 (3 or 4 dry), and chroma of 1 to 3. It is slightly acid or neutral. It is dominantly silty clay loam, but the range includes silt loam. The content of thin, flat limestone fragments that range from 3 to 15 inches in length along the longer axis is less than 15 percent.

Taloka Series

The Taloka series consists of deep, somewhat poorly drained, very slowly permeable soils on uplands. These soils formed in old alluvium mantled by a thin layer of loess. Slope is 0 to 1 percent.

Taloka soils are similar to Cherokee and Parsons soils and are commonly adjacent to Dennis soils. Cherokee soils are lighter colored in the surface layer than the Taloka soils. Parsons soils have a surface soil that is less than 16 inches thick. Dennis soils have a BA horizon. They are on side slopes.

Typical pedon of Taloka silt loam, 0 to 1 percent slopes, 2,000 feet east and 300 feet north of the southwest corner of sec. 1, T. 35 S., R. 23 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable; neutral; clear smooth boundary.

E1—8 to 14 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; slightly hard, friable; neutral; gradual smooth boundary.

E2—14 to 21 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; few fine faint yellowish brown (10YR 5/4) mottles; weak fine

granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

Btg1—21 to 34 inches; dark grayish brown (10YR 4/2) silty clay, grayish brown (10YR 5/2) dry; common fine and medium distinct dark yellowish brown (10YR 4/4) mottles; moderate medium blocky structure; extremely hard, very firm; thin continuous clay films; medium acid; gradual smooth boundary.

Btg2—34 to 45 inches; coarsely mottled dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4), and yellowish brown (10YR 5/6) silty clay, yellowish brown (10YR 5/4) and brownish yellow (10YR 6/6) dry; moderate medium blocky structure; extremely hard, very firm; thin continuous clay films; medium acid; gradual smooth boundary.

Btg3—45 to 60 inches; dark grayish brown (10YR 4/2) silty clay loam, light brownish gray (10YR 6/2) dry; common coarse distinct strong brown (7.5YR 5/6) mottles; weak medium blocky structure; very hard, firm; thin patchy clay films; medium acid.

The thickness of the solum ranges from 40 to more than 60 inches. The thickness of the surface soil ranges from 16 to 30 inches.

The A horizon has hue of 10YR, value of 3 (4 or 5 dry), and chroma of 1 or 2. It is medium acid or strongly acid unless it is limed. The E horizon has hue of 10YR, value of 4 or 5 (5 to 7 dry), and chroma of 2. The Bt horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 to 4 and is mottled with shades of gray, brown, or red. It ranges from neutral to strongly acid.

Tonti Series

The Tonti series consists of deep, moderately well drained, slowly permeable soils on uplands. These soils formed in material weathered from cherty limestone. Slope ranges from 2 to 5 percent.

Tonti soils are commonly adjacent to Gerald and Nixa soils. The somewhat poorly drained Gerald soils are higher on the landscape than the Tonti soils. Also, they have a darker surface layer. Nixa soils have a cherty surface layer. They are lower on the landscape than the Tonti soils.

Typical pedon of Tonti silt loam, 2 to 5 percent slopes, 1,200 feet north and 650 feet east of the southwest corner of sec. 12, T. 34 S., R. 25 E.

A—0 to 9 inches; brown (10YR 5/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; slightly hard, friable; common fine roots; less than 5 percent chert fragments; strongly acid; clear smooth boundary.

BA—9 to 13 inches; yellowish brown (10YR 5/4) cherty silt loam, light yellowish brown (10YR 6/4) dry; moderate fine subangular blocky structure; slightly hard, friable; common fine roots; about 20 percent chert fragments; very strongly acid; clear smooth boundary.

Bt—13 to 19 inches; yellowish brown (10YR 5/4) cherty silty clay loam, light yellowish brown (10YR 6/4) dry; common fine distinct yellowish red (5YR 4/6) mottles; moderate fine subangular blocky structure; hard, firm; few fine roots; thin patchy clay films; about 25 percent chert fragments; very strongly acid; clear wavy boundary.

Bx—19 to 28 inches; strong brown (7.5YR 5/6) and light gray (10YR 7/1) very cherty silty clay loam, reddish yellow (7.5YR 6/6) and white (10YR 8/1) dry; massive; firm; brittle; about 45 percent chert fragments; very strongly acid; clear wavy boundary.

B't—28 to 60 inches; red (2.5YR 4/6) and reddish yellow (5YR 6/6) extremely cherty silty clay loam, red (2.5YR 5/6) and reddish yellow (5YR 6/6) dry; mixed with some streaks of gray (10YR 5/1) silt loam; weak fine subangular blocky structure; hard, firm; about 70 percent chert fragments; very strongly acid.

The solum is more than 60 inches thick. The depth to the fragipan ranges from 15 to 24 inches. Reaction is strongly acid or very strongly acid throughout the profile.

The A horizon has hue of 10YR, value of 4 or 5 (5 or 6 dry), and chroma of 2 or 3. The content of chert fragments in this horizon ranges from 5 to 15 percent. The Bt horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4 to 6.

Verdigris Series

The Verdigris series consists of deep, moderately well drained, moderately permeable soils on flood plains. These soils formed in silty alluvium. Slope ranges from 0 to 2 percent.

Verdigris soils are similar to Hepler and Lanton soils and are commonly adjacent to Hepler, Lanton, and Osage soils. Hepler and Lanton soils have mottles within 16 inches of the surface. Osage soils have a clayey subsoil. They are in concave areas on the flood plains.

Typical pedon of Verdigris silt loam, occasionally flooded, 2,000 feet east and 150 feet south of the northwest corner of sec. 12, T. 35 S., R. 21 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; slightly hard, friable; many fine roots; medium acid; clear smooth boundary.

A1—7 to 27 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; slightly hard, friable; many fine roots; scattered worm casts; slightly acid; gradual smooth boundary.

A2—27 to 45 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable; few fine roots; scattered worm casts; slightly acid; gradual smooth boundary.
C—45 to 60 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; massive; slightly hard, friable; few fine pores; slightly acid.

The solum and the mollic epipedon range from 24 to more than 50 inches in thickness. The soils range from medium acid to neutral throughout. They are silt loam or silty clay loam throughout.

The A horizon has hue of 10YR or 2.5Y, value of 2 or 3 (3 to 5 dry), and chroma of 1 to 3. The C horizon has hue of 2.5Y or 10YR, value of 3 to 5 (4 to 7 dry), and chroma of 2 or 3.

Waben Series

The Waben series consists of deep, well drained, moderately rapidly permeable soils on terraces, alluvial and colluvial fans, and toe slopes. These soils formed in loamy and cherty alluvium and colluvium. Slope ranges from 2 to 5 percent.

Waben soils are similar to Secesh soils and are commonly adjacent to Clarksville and Secesh soils. Secesh soils have a lower content of coarse fragments in the surface layer than the Waben soils. Clarksville soils are on uplands. They are more acid in the subsoil than the Waben soils.

Typical pedon of Waben cherty silt loam, 2 to 5 percent slopes, 2,000 feet south and 200 feet west of the northeast corner of sec. 29, T. 34 S., R. 25 E.

A—0 to 10 inches; dark brown (10YR 3/3) cherty silt loam, brown (10YR 5/3) dry; moderate fine granular structure; slightly hard, friable; common fine roots; about 25 percent rounded chert gravel; few worm casts; slightly acid; gradual smooth boundary.
BA—10 to 18 inches; dark yellowish brown (10YR 4/4) cherty silt loam, light yellowish brown (10YR 6/4) dry; weak fine granular structure; hard, friable; common fine roots; about 30 percent rounded chert gravel; few worm casts; slightly acid; gradual smooth boundary.
Bt—18 to 42 inches; yellowish red (5YR 4/6) very cherty silty clay loam, yellowish red (5YR 5/6) dry; moderate fine subangular blocky structure; hard, firm; few fine roots; about 45 percent chert fragments; medium acid; gradual wavy boundary.
BC—42 to 60 inches; yellowish red (5YR 4/6) very cherty silty clay loam, yellowish red (5YR 5/6) dry; weak fine subangular blocky structure; hard, firm; about 70 percent chert fragments; strongly acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is dominantly cherty silt loam, but the range includes cherty loam. The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5 (5 or 6 dry), and chroma of 3 to 6. It is very cherty silty clay loam or very cherty clay loam.

Zaar Series

The Zaar series consists of deep, somewhat poorly drained, very slowly permeable soils on uplands. These soils formed in material weathered from shale. Slope ranges from 0 to 2 percent.

Zaar soils are similar to Osage soils and are commonly adjacent to Catoosa, Eram, and Parsons soils. Osage soils are poorly drained and are on flood plains. Eram soils are 20 to 40 inches deep over shale. Catoosa and Parsons soils have an argillic horizon. Catoosa and Eram soils are on side slopes, and Parsons soils are on broad ridgetops.

Typical pedon of Zaar silty clay, 0 to 2 percent slopes, 1,500 feet north and 200 feet east of the southwest corner of sec. 31, T. 31 S., R. 23 E.

Ap—0 to 8 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; strong medium granular and fine blocky structure; hard, firm; many fine roots; slightly acid; clear smooth boundary.
A—8 to 15 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; moderate fine and medium blocky structure; very hard, firm; many fine roots; slightly acid; gradual wavy boundary.
Bw1—15 to 24 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; few fine prominent reddish brown (5YR 4/3) mottles; moderate medium blocky structure; extremely hard, very firm; few small black concretions; few slickensides; many fine roots; neutral; gradual wavy boundary.
Bw2—24 to 36 inches; dark brown (10YR 4/3) silty clay, brown (10YR 5/3) dry; common fine prominent reddish brown (5YR 4/3) and few fine faint dark gray (N 4/0) mottles; moderate medium and fine blocky structure; extremely hard, very firm; few small black concretions; few fine roots; large vertical cracks filled with darker material from the horizons above; neutral; gradual wavy boundary.
BC—36 to 52 inches; dark brown (10YR 4/3) silty clay, brown (10YR 5/3) dry; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; extremely hard, very firm; few small black concretions; few slickensides; few large vertical cracks filled with darker material from the horizons above; neutral; gradual wavy boundary.
C—52 to 60 inches; dark gray (10YR 4/1) and yellowish brown (10YR 5/6) silty clay, gray (10YR 5/1) and brownish yellow (10YR 6/6) dry; few fine black

concretions; massive; extremely hard, very firm; neutral.

The solum is more than 40 inches thick. In some pedons small carbonate concretions are in the lower horizons.

The A horizon has hue of 10YR to 2.5YR, value of 2 or 3 (3 or 4 dry), and chroma of 1 or 2. It is dominantly silty clay, but the range includes silty clay loam. This horizon ranges from medium acid to neutral. The Bw horizon has hue of 10YR or 2.5Y, value of 2 to 4 (3 to 5 dry), and chroma of 1 to 3. It is neutral or slightly acid.

Formation of the Soils

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate during and after the accumulation of the soil material, the plant and animal life on and in the soil, the relief, and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are the active factors of soil formation. They act on the material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Some time is always needed for the differentiation of soil horizons. Usually, a long time is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent Material

Parent material is the unconsolidated material in which soils form. It either is material weathered from rocks through freezing and thawing, abrasion, or chemical processes or is weathered material deposited by wind or water. It affects texture, structure, color, natural fertility, and many other soil properties. Soils differ partly because of the various kinds of parent material. The texture of the parent material greatly affects soil formation through its effect on the rate at which water and air move downward through the soil. The composition of the parent material largely determines the mineralogical composition of the soil and thus its natural fertility.

Most of the soils in Cherokee County formed in material weathered from limestone, sandstone, and shale of the Pennsylvanian System and in cherty limestone of the older Mississippian System. Dennis, Eram, and Zaar soils formed in material weathered from shale. Bates, Bolivar, Collinsville, and Hector soils formed in material weathered from sandstone or sandy shale. Catoosa and Shindler soils formed in material weathered from limestone. Clarksville, Gerald, Nixa, and Tonti soils formed in cherty limestone residuum in the southeastern part of the county.

Alluvium is material deposited by streams. The alluvial soils in the county formed in either recent or old alluvium. The recent alluvium is in the stream valleys. Hepler, Lanton, Osage, and Verdigris soils formed in this material. The old alluvium is on what are now uplands. Cherokee, Parsons, and Taloka soils formed in this material.

Climate

Climate is an active factor of soil formation. It directly affects soil formation by weathering the parent material. It indirectly affects soil formation through its effect on plant and animal life.

The climate of Cherokee County is typical continental. It is characterized by intermittent dry and moist periods, which can last for less than a year or for several years. The soil material dries to varying depths during dry periods. It slowly regains moisture during wet periods and can become so saturated that excess moisture penetrates the substratum. As a result of the wetting and drying, some of the basic nutrients, and even clay particles, have been leached from the upper horizons of some soils.

Plant and Animal Life

Plants generally affect the content of nutrients and of organic matter in the soil and the color of the surface layer. Earthworms, cicadas, and burrowing animals help to keep the soil open and porous. Earthworms in Verdigris soils have left worm casts. Bacteria and fungi help to decompose the plants, thus releasing plant nutrients.

The mid and tall prairie grasses have had the greatest influence on soil formation in Cherokee County. As a result of the grasses, the upper part of a typical soil in the county is dark and is high in content of organic matter. The transitional part in many areas is slightly finer textured and somewhat lighter colored than the layer above. The underlying parent material generally is light in color.

The native vegetation on Bolivar, Clarksville, Hector, Nixa, and Tonti soils was hardwood trees. These soils

generally have a thinner surface layer than the soils that formed under prairie grasses.

Relief

Relief affects soil formation through its effect on drainage, runoff, plant cover, and soil temperature. Most important is the effect that it has on the movement of water on the surface and into the soil.

Runoff is more rapid on the steeper upland soils than on the less sloping soils. As a result, less water penetrates the surface and erosion is more extensive. Relief has retarded the formation of Shidler soils, which formed in old parent material. Runoff is rapid on these moderately sloping soils. As a result, much of the soil material is removed as soon as the soil forms. Unlike the Shidler soils, the nearly level and gently sloping soils in the county generally have distinct horizons.

Time

The length of time that the soil material has been subject to the processes of soil formation commonly is reflected in the degree of profile development. Soils that do not have distinct horizons are considered young or immature, whereas those that have distinct horizons are considered old or mature.

The soils in Cherokee County range from immature to mature. Verdigris and other young soils are on bottom land that is subject to stream overflow. They receive new sediments with each flood. They have been in place long enough for the formation of a thick, dark surface layer, but little or no clay has moved downward through the profile. In contrast, the mature Parsons soils have very distinct horizons. Much of the clay has been translocated to the subsoil. Thousands of years were needed for the formation of these mature soils.

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Glossary

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chat. The crushed rock remaining after the extraction of lead and zinc from mines.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the

surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multipled by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural

classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data were recorded in the period 1941-70 at Columbus, Kansas]

Month	Temperature					Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	In	In	In		In
January----	44.9	23.9	34.4	71	- 5	1.44	0.42	2.07	3	2.3
February---	50.0	28.2	39.1	75	2	1.57	.94	2.17	3	2.4
March------	57.5	34.5	46.0	85	10	2.39	.92	3.66	5	2.4
April------	70.0	47.0	58.5	87	23	4.20	2.15	5.21	7	.2
May--------	77.6	55.7	66.7	91	34	5.42	3.46	6.33	8	.0
June-------	85.7	64.5	75.1	98	47	5.80	2.04	7.06	7	.0
July-------	90.9	67.7	79.3	104	50	3.97	.73	6.26	5	.0
August-----	91.2	66.1	78.7	105	50	3.19	1.15	4.76	5	.0
September--	83.7	58.2	71.0	99	37	5.33	1.74	9.22	6	.0
October----	74.3	47.9	61.1	92	25	3.40	1.14	5.15	5	.0
November---	59.2	35.8	47.5	80	10	2.09	.54	5.18	4	1.0
December---	48.0	27.6	37.8	72	- 4	1.72	.84	2.45	4	2.1
Year-----	69.4	46.4	57.9	106	- 7	40.52	33.84	48.25	62	10.4

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Minimum temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 2	April 15	April 25
2 years in 10 later than--	March 28	April 10	April 20
5 years in 10 later than--	March 19	March 31	April 10
First freezing temperature in fall:			
1 year in 10 earlier than--	November 3	October 20	October 11
2 years in 10 earlier than--	November 7	October 25	October 15
5 years in 10 earlier than--	November 17	November 3	October 25

TABLE 3.--GROWING SEASON

Probability	Length of growing season if daily minimum temperature is--		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	217	196	178
8 years in 10	226	203	185
5 years in 10	243	217	198
2 years in 10	260	231	212
1 year in 10	269	239	219

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Be	Bates loam, 1 to 3 percent slopes	19,750	5.2
Bf	Bates loam, 3 to 6 percent slopes	3,550	0.9
Bh	Bates-Collinsville complex, 4 to 15 percent slopes	4,400	1.2
Bo	Bolivar-Hector fine sandy loams, 4 to 15 percent slopes	3,750	1.0
Br	Brazilton silty clay loam, 1 to 3 percent slopes	100	*
Cd	Catoosa silt loam, 0 to 2 percent slopes	2,550	0.7
Ce	Cherokee silt loam, 0 to 1 percent slopes	17,900	4.7
Ck	Clarksville very cherty silt loam, 10 to 30 percent slopes	7,800	2.1
Db	Dennis silt loam, 1 to 3 percent slopes	92,400	24.4
Du	Dumps, mine	3,250	0.9
En	Eram silty clay loam, 3 to 7 percent slopes	1,950	0.5
Es	Eram-Shidler silty clay loams, 4 to 12 percent slopes	1,150	0.3
Ge	Gerald silt loam, 0 to 2 percent slopes	800	0.2
He	Hepler silt loam, occasionally flooded	32,150	8.5
Hf	Hepler silt loam, frequently flooded	18,850	5.0
Ka	Kanima shaly silty clay loam, 3 to 10 percent slopes	7,650	2.0
Kn	Kanima shaly silty clay loam, 15 to 50 percent slopes	14,200	3.7
Ln	Lanton silt loam, occasionally flooded	6,150	1.6
Ns	Nixa cherty silt loam, 2 to 9 percent slopes	6,650	1.8
Os	Osage silty clay, occasionally flooded	10,500	2.8
Pr	Parsons silt loam, 0 to 2 percent slopes	88,275	23.3
Se	Secesh silt loam	800	0.2
Sf	Secesh silt loam, channeled	400	0.1
To	Taloka silt loam, 0 to 1 percent slopes	20,000	5.3
Tt	Tonti silt loam, 2 to 5 percent slopes	2,700	0.7
Vb	Verdigris silt loam, occasionally flooded	3,200	0.8
Wa	Waben cherty silt loam, 2 to 5 percent slopes	1,550	0.4
Za	Zaar silty clay, 0 to 2 percent slopes	5,500	1.5
	Water	750	0.2
	Total	378,675	100.0

* Less than 0.1 percent.

TABLE 5.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Land capability	Winter wheat	Grain sorghum	Soybeans	Tall fescue
		Bu	Bu	Bu	AUM*
Be----------------------- Bates	IIe	37	57	26	5.5
Bf----------------------- Bates	IIIe	32	50	22	5.0
Bh----------------------- Bates-Collinsville	VIe	---	---	---	4.0
Bo----------------------- Bolivar-Hector	VIe	---	---	---	3.5
Br----------------------- Brazilton	IIIe	28	60	22	4.5
Cd----------------------- Catoosa	IIe	40	62	28	5.5
Ce----------------------- Cherokee	IIs	35	63	28	4.5
Ck----------------------- Clarksville	VIIs	---	---	---	3.0
Db----------------------- Dennis	IIe	41	73	32	6.0
Du**. Dumps					
En----------------------- Eram	IVe	24	50	19	4.5
Es----------------------- Eram-Shidler	VIe	---	---	---	3.0
Ge----------------------- Gerald	IIIw	34	65	28	5.0
He----------------------- Hepler	IIw	40	80	32	7.5
Hf----------------------- Hepler	Vw	---	---	---	7.5
Ka----------------------- Kanima	VIs	---	---	---	1.0
Kn----------------------- Kanima	VIIs	---	---	---	---
Ln----------------------- Lanton	IIw	37	95	34	7.5
Ns----------------------- Nixa	IVs	---	---	---	5.0
Os----------------------- Osage	IIIw	32	65	30	5.5
Pr----------------------- Parsons	IIs	35	70	30	5.0

See footnotes at end of table.

TABLE 5.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Winter wheat	Grain sorghum	Soybeans	Tall fescue
		Bu	Bu	Bu	AUM*
Se------------------------- Secesh	IIs	37	65	35	5.5
Sf------------------------- Secesh	Vw	---	---	---	5.5
To------------------------- Taloka	IIs	35	73	33	5.5
Tt------------------------- Tonti	IVe	25	50	19	4.0
Vb------------------------- Verdigris	IIw	41	96	35	7.0
Wa------------------------- Waben	IIIs	25	40	19	5.0
Za------------------------- Zaar	IIIw	38	66	27	5.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
Bo*:								
Bolivar	4a	Slight	Slight	Slight	Slight	Post oak	40	White oak, green ash.
						Blackjack oak	40	
						Northern red oak	60	
						Black walnut	57	
Hector	5d	Slight	Slight	Moderate	---------	Post oak	38	White oak, green ash.
						Blackjack oak	35	
Ck Clarksville	4r	Slight	Moderate	Moderate	Slight	White oak	58	Upland oaks.
						Hickory	50	
						Hackberry	50	
He, Hf Hepler	3a	Slight	Slight	Slight	Moderate	Eastern cottonwood	90	Pecan, green ash, black walnut, northern red oak, bur oak.
						Northern red oak	67	
						Hackberry	76	
						Green ash	70	
						Pin oak	80	
Ln Lanton	3a	Slight	Slight	Slight	Moderate	Eastern cottonwood	85	Eastern cottonwood, pecan, black walnut, bur oak.
						Green ash	71	
						Northern red oak	70	
						Pin oak	80	
						Hackberry	70	
Ns Nixa	4f	Slight	Slight	Moderate	---------	Post oak	60	Green ash, southern red oak.
						Blackjack oak	43	
Os Osage	4w	Slight	Moderate	Severe	Severe	Pin oak	75	Pin oak, pecan, northern red oak, bur oak.
						Pecan	50	
						Eastern cottonwood	85	
						Bur oak	60	
						Green ash	70	
Sf Secesh	4a	Slight	Slight	Slight	Slight	White oak	60	Black walnut, pecan, green ash, northern red oak.
						American sycamore	75	
						Black walnut	70	
						Black oak	70	
Tt Tonti	4a	Slight	Slight	Slight	---------	Black walnut	55	Black walnut, southern red oak, green ash.
Vb Verdigris	3a	Slight	Slight	Slight	Moderate	Eastern cottonwood	87	Eastern cottonwood, pin oak, black walnut, green ash, pecan.
						Pin oak	75	
						Shagbark hickory	50	
						Hackberry	69	
						Black walnut	69	
						Green ash	69	
						White oak	56	
						Northern red oak	70	
Wa Waben	3f	Slight	Slight	Moderate	---------	Southern red oak	70	Black walnut, southern red oak, pecan.
						Black walnut	---	
						White oak	---	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
Be, Bf: Bates	Lilac, Peking cotoneaster, Amur honeysuckle, fragrant sumac.	---	Eastern redcedar, green ash, Austrian pine, bur oak, hackberry, Russian-olive.	Siberian elm, honeylocust.	---
Bh*:					
Bates	Lilac, Peking cotoneaster, Amur honeysuckle, fragrant sumac.	---	Eastern redcedar, green ash, Austrian pine, hackberry, Russian-olive.	Siberian elm, honeylocust.	---
Collinsville	---	---	---	---	---
Bo*:					
Bolivar	Amur honeysuckle, lilac, fragrant sumac.	Autumn-olive	Green ash, hackberry, bur oak, Russian-olive, Austrian pine, eastern redcedar.	Siberian elm, honeylocust.	---
Hector.					
Br: Brazilton	Lilac, Peking cotoneaster.	Siberian peashrub, Manchurian crabapple, Amur honeysuckle.	Eastern redcedar, hackberry, Russian-olive, Austrian pine, green ash.	Honeylocust, Siberian elm.	---
Cd: Catoosa	Amur honeysuckle, fragrant sumac, Peking cotoneaster, lilac.	---	Russian-olive, hackberry, eastern redcedar, green ash, Austrian pine.	Honeylocust, Siberian elm.	---
Ce: Cherokee	Peking cotoneaster, lilac.	Amur honeysuckle, Siberian peashrub, Manchurian crabapple.	Green ash, hackberry, Austrian pine, eastern redcedar, Russian-olive.	Honeylocust, Siberian elm.	---
Ck: Clarksville	Amur honeysuckle, lilac, fragrant sumac.	Autumn-olive	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, Russian-olive.	Siberian elm	---
Db: Dennis	American plum, fragrant sumac, Peking cotoneaster, lilac.	---	Flowering dogwood, Russian mulberry, hackberry, eastern redcedar, green ash.	Honeylocust, Austrian pine, Scotch pine.	---
Du*. Dumps					
En: Eram	Lilac, Peking cotoneaster.	Manchurian crabapple, Amur honeysuckle, Siberian peashrub.	Eastern redcedar, hackberry, green ash, Austrian pine, Russian-olive.	Siberian elm, honeylocust.	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
Es*:					
Eram	Lilac, Peking cotoneaster.	Manchurian crabapple, Amur honeysuckle, Siberian peashrub.	Eastern redcedar, hackberry, green ash, Austrian pine, Russian-olive.	Siberian elm, honeylocust.	---
Shidler	Skunkbush sumac, Amur honeysuckle, lilac.	Rocky Mountain juniper, redbud.	Eastern redcedar, oriental arborvitae, osageorange, Arizona cypress.	---	---
Ge-- Gerald	Lilac	Manchurian crabapple, Amur honeysuckle, Amur maple, autumn-olive.	Eastern redcedar, Austrian pine, hackberry, green ash, jack pine, Russian-olive.	Honeylocust	---
He, Hf-- Hepler	---	Peking cotoneaster, Amur honeysuckle, lilac, American plum.	Eastern redcedar	Austrian pine, eastern white pine, honeylocust, hackberry, green ash, bur oak.	Eastern cottonwood.
Ka, Kn. Kanima					
Ln-- Lanton	---	Amur honeysuckle, lilac, Amur maple, autumn-olive.	Eastern redcedar	Austrian pine, pin oak, green ash, hackberry, honeylocust, eastern white pine.	Eastern cottonwood.
Ns-- Nixa	Amur honeysuckle, fragrant sumac, lilac.	Autumn-olive	Russian-olive, eastern redcedar, hackberry, bur oak, green ash, Austrian pine, honeylocust.	Siberian elm	---
Os-- Osage	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, hackberry.	Norway spruce, honeylocust, green ash, silver maple, golden willow, northern red oak.	Eastern cottonwood.
Pr-- Parsons	Peking cotoneaster, lilac.	Amur honeysuckle, Siberian peashrub, Manchurian crabapple.	Eastern redcedar, Austrian pine, green ash, Russian-olive, hackberry.	Honeylocust, Siberian elm.	---
Se, Sf-- Secesh	---	Autumn-olive, Amur honeysuckle, Amur maple, lilac.	Eastern redcedar	Austrian pine, honeylocust, pin oak, eastern white pine, hackberry, green ash.	Eastern cottonwood.
To-- Taloka	Lilac, Peking cotoneaster.	Manchurian crabapple, Amur honeysuckle, Siberian peashrub.	Eastern redcedar, Austrian pine, hackberry, green ash, Russian-olive.	Honeylocust, Siberian elm.	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Tt----------------- Tonti	Lilac, Amur honeysuckle, fragrant sumac.	Amur honeysuckle, Amur maple, autumn-olive, Manchurian crabapple.	Eastern redcedar, Russian-olive, hackberry, green ash, Austrian pine, jack pine.	Honeylocust, Siberian elm.	---
Vb----------------- Verdigris	---	American plum, lilac, Peking cotoneaster, Amur honeysuckle.	Eastern redcedar	Austrian pine, honeylocust, eastern white pine, bur oak, green ash, hackberry.	Eastern cottonwood.
Wa----------------- Waben	Amur honeysuckle, fragrant sumac, lilac.	Autumn-olive------	Russian-olive, eastern redcedar, hackberry, bur oak, green ash, Austrian pine, honeylocust.	Siberian elm------	---
Za----------------- Zaar	Peking cotoneaster, lilac, Amur honeysuckle, Siberian peashrub.	Eastern redcedar, Manchurian crabapple.	Austrian pine, Russian-olive, hackberry, green ash, honeylocust.	Siberian elm------	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Be, Bf------ Bates	Slight------	Slight------	Moderate: slope, small stones, depth to rock.	Slight.
Bh*:				
Bates------	Slight------	Slight------	Moderate: slope, small stones, depth to rock.	Slight.
Collinsville------	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, small stones.	Slight.
Bo*:				
Bolivar------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Hector------	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
Br------ Brazilton	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight.
Cd------ Catoosa	Slight------	Slight------	Slight------	Severe: erodes easily.
Ce------ Cherokee	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.
Ck------ Clarksville	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.
Db------ Dennis	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.
Du*. Dumps				
En------ Eram	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight.
Es*:				
Eram------	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: slope.	Slight.
Shidler------	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
Ge------ Gerald	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
He------- Hepler	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
Hf------- Hepler	Severe: flooding, wetness.	Moderate: flooding, wetness, percs slowly.	Severe: wetness, flooding.	Moderate: wetness, flooding.
Ka------- Kanima	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Slight.
Kn------- Kanima	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
Ln------- Lanton	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
Ns------- Nixa	Severe: small stones, percs slowly.	Severe: small stones, percs slowly.	Severe: small stones, percs slowly.	Severe: erodes easily, small stones.
Os------- Osage	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness.	Severe: wetness, too clayey.
Pr------- Parsons	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, erodes easily.
Se------- Secesh	Severe: flooding.	Slight-------	Moderate: small stones.	Slight.
Sf------- Secesh	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
To------- Taloka	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Severe: erodes easily.
Tt------- Tonti	Moderate: small stones, percs slowly.	Moderate: small stones, percs slowly.	Severe: small stones.	Severe: erodes easily.
Vb------- Verdigris	Severe: flooding.	Slight-------	Moderate: flooding.	Slight.
Wa------- Waben	Severe: small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones.
Za------- Zaar	Severe: wetness, percs slowly, too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey, wetness.	Severe: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Be, Bf-------------- Bates	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Bh*:												
Bates--------------	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Collinsville-------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Bo*:												
Bolivar------------	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Fair.
Hector-------------	Very poor.	Poor	Poor	Poor	Very poor.	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Br----------------- Brazilton	Fair	Good	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor	Fair.
Cd----------------- Catoosa	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Ce----------------- Cherokee	Fair	Good	Good	Good	Good	Good	Fair	Poor	Good	Good	Fair	Fair.
Ck----------------- Clarksville	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Db----------------- Dennis	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
Du*. Dumps												
En----------------- Eram	Fair	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
Es*:												
Eram---------------	Fair	Good	Good	Good	Good	Fair	Very poor.	Very poor.	Good	Good	Very poor.	Fair.
Shidler------------	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
Ge----------------- Gerald	Fair	Good	Good	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair.
He, Hf------------- Hepler	Fair	Good	Good	Good	Good	Good	Good	Fair	Good	Good	Fair	Good.
Ka, Kn------------- Kanima	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Poor.
Ln----------------- Lanton	Good	Good	Good	Good	Good	Good	Fair	Good	Good	Good	Fair	Good.
Ns----------------- Nixa	Poor	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.	Fair.
Os----------------- Osage	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Pr----------------- Parsons	Fair	Good	Good	Good	Good	Good	Fair	Poor	Good	Good	Fair	Fair.
Se, Sf------------- Secesh	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
To----------------- Taloka	Fair	Good	Good	Good	Good	Good	Fair	Poor	Good	Good	Fair	Fair.
Tt----------------- Tonti	Fair	Good	Good	Fair	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.	Fair.
Vb----------------- Verdigris	Good	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor	Good.
Wa----------------- Waben	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Fair	Fair.
Za----------------- Zaar	Fair	Fair	Fair	Good	Good	Good	Poor	Fair	Fair	Good	Poor	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Be: Bates	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Slight	Moderate: low strength.
Bf: Bates	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Moderate: low strength.
Bh*: Bates	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Moderate: low strength.
Collinsville	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
Bo*: Bolivar	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, shrink-swell.
Hector	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
Br: Brazilton	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Cd: Catoosa	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Moderate: shrink-swell, depth to rock.
Ce: Cherokee	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.
Ck: Clarksville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Db: Dennis	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Du*. Dumps					
En: Eram	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Es*: Eram	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Shidler	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Ge: Gerald	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
He, Hf------------ Hepler	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.
Ka---------------- Kanima	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Slight.
Kn---------------- Kanima	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ln---------------- Lanton	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding.
Ns---------------- Nixa	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Slight.
Os---------------- Osage	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.
Pr---------------- Parsons	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.
Se---------------- Secesh	Slight-----------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Sf---------------- Secesh	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
To---------------- Taloka	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell.
Tt---------------- Tonti	Slight-----------	Slight-----------	Slight-----------	Slight------------	Slight.
Vb---------------- Verdigris	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Wa---------------- Waben	Slight-----------	Slight-----------	Slight-----------	Slight------------	Slight.
Za---------------- Zaar	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "poor," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Be, Bf: Bates	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Bh*:					
Bates	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Collinsville	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock.	Poor: area reclaim.
Bo*:					
Bolivar	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Hector	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim, small stones, thin layer.
Br: Brazilton	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Cd: Catoosa	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
Ce: Cherokee	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Ck: Clarksville	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: small stones, slope.
Db: Dennis	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
Du*. Dumps					
En: Eram	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Es*:					
Eram	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Shidler	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ge: Gerald	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: small stones, wetness.
He, Hf: Hepler	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, wetness.
Ka: Kanima	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Poor: small stones.
Kn: Kanima	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Ln: Lanton	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness, thin layer.
Ns: Nixa	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Poor: small stones.
Os: Osage	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Pr: Parsons	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Se: Secesh	Moderate: flooding, percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
Sf: Secesh	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Poor: small stones.
To: Taloka	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Tt: Tonti	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Poor: small stones.
Vb: Verdigris	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Wa: Waben	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.
Za: Zaar	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Be, Bf: Bates	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
Bh*:				
Bates	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
Collinsville	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Bo*:				
Bolivar	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, slope.
Hector	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Br: Brazilton	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Cd: Catoosa	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer, too clayey.
Ce: Cherokee	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
Ck: Clarksville	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Db: Dennis	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, thin layer.
Du*. Dumps				
En: Eram	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey.
Es*:				
Eram	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Es*:				
Shidler	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Ge Gerald	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
He, Hf Hepler	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Ka Kanima	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Kn Kanima	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Ln Lanton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Ns Nixa	Slight	Improbable: small stones.	Probable	Poor: small stones, area reclaim.
Os Osage	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Pr Parsons	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
Se, Sf Secesh	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
To Taloka	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Tt Tonti	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Vb Verdigris	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Wa Waben	Good	Improbable: small stones.	Probable	Poor: small stones, area reclaim.
Za Zaar	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Be: Bates	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
Bf: Bates	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
Bh*: Bates	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
Collinsville	Severe: depth to rock, slope.	Slight	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Bo*: Bolivar	Severe: slope.	Severe: thin layer.	Deep to water	Soil blowing, depth to rock, slope.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
Hector	Severe: depth to rock.	Severe: thin layer, piping.	Deep to water	Droughty, depth to rock, slope.	Slope, depth to rock.	Slope, droughty, depth to rock.
Br: Brazilton	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Percs slowly	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Cd: Catoosa	Moderate: seepage, depth to rock.	Severe: thin layer.	Deep to water	Depth to rock, rooting depth.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
Ce: Cherokee	Slight	Severe: wetness.	Percs slowly	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Ck: Clarksville	Severe: seepage, slope.	Moderate: large stones.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Db: Dennis	Slight	Moderate: hard to pack, wetness.	Percs slowly	Wetness, percs slowly, rooting depth.	Erodes easily, wetness, percs slowly.	Erodes easily, rooting depth, percs slowly.
Du*. Dumps						
En: Eram	Moderate: depth to rock, slope.	Moderate: thin layer, hard to pack, wetness.	Percs slowly, depth to rock, slope.	Wetness, percs slowly.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
Es*: Eram	Severe: slope.	Moderate: thin layer, hard to pack, wetness.	Percs slowly, depth to rock, slope.	Wetness, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Shidler	Severe: depth to rock.	Severe: thin layer, hard to pack.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
Ge: Gerald	Slight	Moderate: piping, wetness.	Percs slowly, frost action.	Wetness, droughty, percs slowly.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, droughty.
He, Hf: Hepler	Moderate: seepage.	Severe: wetness.	Flooding	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
Ka: Kanima	Moderate: seepage, slope.	Slight	Deep to water	Droughty, slope.	Favorable	Droughty.
Kn: Kanima	Severe: slope.	Slight	Deep to water	Droughty, slope.	Slope	Slope, droughty.
Ln: Lanton	Slight	Severe: piping, wetness.	Percs slowly, flooding.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.
Ns: Nixa	Slight	Moderate: seepage, piping.	Deep to water	Droughty, percs slowly, erodes easily.	Large stones, erodes easily, rooting depth.	Erodes easily, droughty, rooting depth.
Os: Osage	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding.	Wetness, droughty, slow intake.	Wetness, percs slowly.	Wetness, droughty, percs slowly.
Pr: Parsons	Slight	Severe: wetness.	Percs slowly	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Se, Sf: Secesh	Severe: seepage.	Slight	Deep to water	Favorable	Large stones	Favorable.
To: Taloka	Moderate: seepage.	Severe: hard to pack, wetness.	Percs slowly	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Tt: Tonti	Slight	Severe: seepage.	Deep to water	Droughty, percs slowly, rooting depth.	Erodes easily, rooting depth.	Erodes easily, droughty.
Vb: Verdigris	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Favorable	Favorable.
Wa: Waben	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Favorable	Droughty.
Za: Zaar	Slight	Moderate: hard to pack, wetness.	Percs slowly	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Be---------------- Bates	0-13	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	90-100	85-100	80-100	55-90	20-40	3-15
	13-34	Loam, clay loam, sandy clay loam.	ML, CL, SC, SM	A-4, A-6, A-7	0	85-100	85-100	80-100	45-85	25-45	3-20
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Bf---------------- Bates	0-7	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	90-100	85-100	80-100	55-90	20-40	3-15
	7-24	Loam, clay loam, sandy clay loam.	ML, CL, SC, SM	A-4, A-6, A-7	0	85-100	85-100	80-100	45-85	25-45	3-20
	24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Bh*: Bates-----------	0-8	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	90-100	85-100	80-100	55-90	20-40	3-15
	8-27	Loam, clay loam, sandy clay loam.	ML, CL, SC, SM	A-4, A-6, A-7	0	85-100	85-100	80-100	45-85	25-45	3-20
	27	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Collinsville----	0-9	Fine sandy loam	SM, SC, ML, CL	A-4	0-3	80-100	60-100	60-95	36-75	<30	NP-10
	9-14	Fine sandy loam, loam, extremely stony fine sandy loam.	SM, SC, ML, CL	A-4	3-40	80-100	60-100	60-95	36-75	<30	NP-10
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Bo*: Bolivar---------	0-12	Fine sandy loam	ML, SM	A-4	0	100	90-100	70-95	40-55	20-30	NP-5
	12-36	Loam, sandy clay loam, clay loam.	CL, SC	A-6	0-10	85-100	85-100	70-95	45-80	25-40	10-25
	36-46	Weathered bedrock	---	---	---	---	---	---	---	---	---
	46	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Hector----------	0-7	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4, A-2	0	80-100	80-100	80-100	30-65	<30	NP-7
	7-15	Fine sandy loam, gravelly fine sandy loam, gravelly loam.	SM, ML, GM, GM-GC	A-4, A-2	0-15	55-100	55-100	45-100	30-65	<30	NP-7
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Br---------------- Brazilton	0-8	Silty clay loam	CL	A-6, A-7	0-5	95-100	90-100	85-100	70-95	35-50	15-25
	8-40	Silty clay loam, silty clay, clay loam.	CL, CH	A-7	0-5	95-100	90-100	85-100	70-95	45-60	20-35
	40-60	Extremely shaly silty clay loam, extremely shaly silty clay.	CL, CH	A-6, A-7	0-5	40-60	30-50	20-40	10-30	30-55	10-30
Cd---------------- Catoosa	0-12	Silt loam--------	CL	A-4, A-6	0	100	100	96-100	65-97	30-37	8-14
	12-28	Silty clay loam, clay loam.	CL	A-6, A-7	0	85-100	85-100	85-100	70-98	33-48	12-22
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ce---------------- Cherokee	0-14	Silt loam---------	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	80-95	20-35	2-15
	14-47	Clay, silty clay	CH, CL, MH	A-7	0	100	100	95-100	85-95	45-70	20-40
	47-60	Silty clay loam, clay, silty clay.	CH, CL	A-7,A-6	0	100	100	95-100	85-95	35-70	15-40
Ck---------------- Clarksville	0-23	Very cherty silt loam.	GC, SC, SM-SC, GP-GC	A-2-4, A-2-6, A-1-a	5-20	30-70	10-60	5-50	5-35	20-40	5-15
	23-60	Very cherty silty clay loam, extremely cherty silty clay loam.	GC, SC, SP-SC, GP-GC	A-2-6, A-6	5-20	30-70	10-60	10-50	5-45	30-40	15-25
Db---------------- Dennis	0-11	Silt loam---------	ML, CL, CL-ML	A-4, A-6	0	100	100	96-100	65-97	20-37	1-15
	11-19	Silty clay loam, clay loam.	CL	A-6, A-7	0	98-100	98-100	94-100	75-98	33-48	13-25
	19-60	Clay, silty clay, silty clay loam.	CL, CH	A-7, A-6	0	98-100	98-100	94-100	75-98	37-65	15-35
Du*. Dumps											
En---------------- Eram	0-11	Silty clay loam	CL	A-6, A-7	0	85-100	85-100	85-100	75-95	33-48	12-25
	11-32	Clay, silty clay, clay loam.	CL, CH	A-7, A-6	0	95-100	95-100	90-100	85-98	37-65	15-35
	32	Weathered bedrock	---	---	---	---	---	---	---	---	---
Es*:											
Eram-------------	0-8	Silty clay loam	CL	A-6, A-7	0	85-100	85-100	85-100	75-95	33-48	12-25
	8-26	Clay, silty clay, clay loam.	CL, CH	A-7, A-6	0	95-100	95-100	90-100	85-98	37-65	15-35
	26	Weathered bedrock	---	---	---	---	---	---	---	---	---
Shidler----------	0-12	Silty clay loam	CL, CH	A-6, A-7	0-25	75-100	75-100	70-100	65-98	33-55	12-27
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Ge---------------- Gerald	0-13	Silt loam---------	CL	A-6	0-5	95-100	85-100	80-95	75-90	30-40	11-20
	13-22	Silty clay loam, silty clay, clay.	CL, CH	A-7	0-5	85-100	70-100	65-95	60-90	43-55	21-30
	22-30	Silt loam, silty clay loam, cherty silty clay loam.	SC, CL, GC	A-2-6, A-2-7, A-6, A-7	0-5	65-95	35-85	30-80	30-70	35-45	14-21
	30-60	Very cherty silty clay loam, extremely cherty silty clay.	SC, CL, CH, GC	A-2-7, A-7	0-5	40-85	35-65	35-65	30-60	43-65	21-39
He, Hf----------- Hepler	0-23	Silt loam---------	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	75-95	20-35	2-15
	23-60	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	30-50	11-25
Ka, Kn----------- Kanima	0-6	Shaly silty clay loam.	CL, SC	A-6	0-10	50-75	50-75	50-75	40-75	33-40	12-18
	6-60	Very shaly clay loam, extremely shaly silty clay loam, very shaly loam.	GC, GP-GC	A-2, A-4, A-6	0-10	5-50	5-50	5-50	5-49	30-40	8-18
Ln---------------- Lanton	0-7	Silt loam---------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-95	25-38	6-15
	7-39	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	100	95-100	85-100	80-95	30-38	8-16
	39-60	Clay, silty clay, silty clay loam.	MH, CH, CL	A-7	0	100	95-100	85-100	75-95	40-55	18-28

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Ns------------- Nixa	0-5	Cherty silt loam	GM, SM, GC, SC	A-1, A-2, A-4	0-10	40-70	30-60	25-55	20-50	<25	NP-8
	5-18	Extremely cherty silt loam, extremely cherty silty clay loam.	GC, GM, SC, SM	A-1, A-2, A-4	0-10	40-70	30-60	25-55	20-50	<30	NP-8
	18-60	Very cherty silt loam, very cherty silty clay loam.	GC, GM, SC, SM	A-1, A-2, A-4	0-10	40-70	30-60	25-55	20-50	<30	NP-8
Os------------- Osage	0-17	Silty clay-------	CH	A-7	0	100	100	100	95-100	50-75	30-55
	17-60	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	100	100	95-100	40-80	20-50
Pr------------- Parsons	0-14	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	96-100	96-100	80-97	20-37	1-12
	14-60	Clay, silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	96-100	96-100	80-99	37-70	15-40
Se, Sf---------- Secesh	0-10	Silt loam--------	ML	A-4	0-10	85-100	80-100	75-95	60-90	20-30	NP-7
	10-25	Silty clay loam, silt loam.	CL, CL-ML	A-4, A-6	0-10	80-100	75-100	70-95	60-90	25-35	5-12
	25-60	Very cherty silty clay loam, extremely cherty clay loam, cherty sandy clay.	GC, SC, GP-GC, SP-SC	A-6, A-2-6	15-45	40-70	25-65	20-45	10-40	30-40	11-20
To------------- Taloka	0-21	Silt loam--------	ML, CL	A-4, A-6	0	100	100	96-100	80-97	30-37	8-13
	21-60	Clay loam, silty clay loam, silty clay.	CL, CH, MH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-38
Tt------------- Tonti	0-9	Silt loam--------	ML	A-4	0-5	70-90	70-90	65-85	60-70	<20	NP-3
	9-19	Cherty silty clay loam, cherty silt loam.	ML, CL	A-4, A-6	0-5	70-85	65-85	60-80	55-75	20-40	5-15
	19-60	Very cherty silty clay loam, extremely cherty silty clay loam.	CL-ML, CL, SM-SC, SC	A-4, A-6	0-5	45-70	45-70	40-65	40-60	20-40	5-20
Vb------------- Verdigris	0-7	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	65-100	22-38	2-13
	7-60	Silt loam, silty clay loam.	CL	A-4, A-6, A-7	0	100	100	95-100	80-100	30-45	8-23
Wa------------- Waben	0-18	Cherty silt loam	GM, GM-GC, GP-GM	A-1, A-2	0-10	20-53	15-50	10-40	5-35	<30	NP-7
	18-60	Very cherty silt loam, very cherty silty clay loam, very cherty clay loam.	GM, GC, GP-GM, GM-GC	A-1, A-2	0-10	20-53	15-50	10-40	5-35	20-40	3-20
Za------------- Zaar	0-15	Silty clay-------	CH	A-7	0	100	100	95-100	90-100	50-70	25-40
	15-52	Silty clay, clay	CH	A-7	0	100	100	95-100	90-100	50-70	25-40
	52-60	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	90-100	40-65	15-40

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors		Wind erodi- bility group	Organic matter
									K	T		
	In	Pct	g/cm^3	In/hr	In/in	pH	mmhos/cm					Pct
Be: Bates	0-13	15-27	1.40-1.50	0.6-2.0	0.20-0.24	5.1-6.5	<2	Low	0.28	4	6	1-4
	13-34	18-35	1.50-1.60	0.6-2.0	0.15-0.19	5.1-6.5	<2	Low	0.28			
	34	---	---	---	---	---	---	---	---			
Bf: Bates	0-7	15-27	1.40-1.50	0.6-2.0	0.20-0.24	5.1-6.5	<2	Low	0.28	4	6	1-4
	7-24	18-35	1.50-1.60	0.6-2.0	0.15-0.19	5.1-6.5	<2	Low	0.28			
	24	---	---	---	---	---	---	---	---			
Bh*:												
Bates	0-8	15-27	1.40-1.50	0.6-2.0	0.20-0.24	5.1-6.5	<2	Low	0.28	4	5	1-4
	8-27	18-35	1.50-1.60	0.6-2.0	0.15-0.19	5.1-6.5	<2	Low	0.28			
	27	---	---	---	---	---	---	---	---			
Collinsville	0-9	5-20	1.30-1.65	2.0-6.0	0.12-0.16	5.1-6.5	<2	Low	0.20	2	3	1-2
	9-14	5-20	1.30-1.65	2.0-6.0	0.09-0.13	5.1-6.5	<2	Low	0.20			
	14	---	---	---	---	---	---	---	---			
Bo*:												
Bolivar	0-12	12-18	1.20-1.45	2.0-6.0	0.16-0.18	5.1-6.0	<2	Low	0.24	4	3	.5-2
	12-36	20-35	1.30-1.50	0.6-2.0	0.12-0.16	4.5-6.0	<2	Moderate	0.32			
	36-46	---	---	---	---	---	---	---	---			
	46	---	---	---	---	---	---	---	---			
Hector	0-7	5-20	1.30-1.60	2.0-6.0	0.10-0.14	5.1-6.5	<2	Low	0.24	1	3	---
	7-15	10-25	1.30-1.60	2.0-6.0	0.08-0.15	4.5-5.5	<2	Low	0.17			
	15	---	---	---	---	---	---	---	---			
Br: Brazilton	0-8	28-40	1.40-1.60	0.06-0.2	0.15-0.18	5.1-7.3	<2	Moderate	0.43	4	7	1-4
	8-40	35-55	1.50-1.70	<0.06	0.10-0.15	5.1-7.3	<2	High	0.28			
	40-60	28-45	1.45-1.65	0.6-2.0	0.02-0.05	5.1-8.4	<4	Low	0.28			
Cd: Catoosa	0-12	15-26	1.30-1.55	0.6-2.0	0.15-0.24	5.6-6.5	<2	Low	0.32	3	6	1-3
	12-28	27-39	1.45-1.70	0.6-2.0	0.15-0.22	5.1-7.3	<2	Moderate	0.32			
	28	---	---	---	---	---	---	---	---			
Ce: Cherokee	0-14	10-27	1.25-1.35	0.6-2.0	0.22-0.24	4.5-7.3	<2	Low	0.43	4	6	<2
	14-47	40-50	1.35-1.50	<0.06	0.10-0.15	4.5-6.0	<2	High	0.32			
	47-60	35-50	1.35-1.45	<0.2	0.09-0.18	5.1-7.3	<2	High	0.32			
Ck: Clarksville	0-23	14-20	1.30-1.60	2.0-6.0	0.07-0.12	3.6-6.0	<2	Low	0.28	2	8	1-2
	23-60	25-35	1.40-1.65	2.0-6.0	0.06-0.10	3.6-5.5	<2	Low	0.28			
Db: Dennis	0-11	10-27	1.30-1.55	0.6-2.0	0.15-0.20	5.1-6.0	<2	Low	0.37	4	6	1-3
	11-19	27-35	1.45-1.70	0.2-0.6	0.15-0.20	4.5-6.0	<2	Moderate	0.37			
	19-60	35-55	1.35-1.65	0.06-0.2	0.15-0.20	5.1-8.4	<2	High	0.37			
Du*. Dumps												
En: Eram	0-11	27-40	1.30-1.60	0.2-0.6	0.15-0.19	5.6-6.5	<2	Moderate	0.37	3	7	1-3
	11-32	35-55	1.45-1.75	0.06-0.2	0.14-0.18	5.1-7.3	<2	High	0.37			
	32	---	---	---	---	---	---	---	---			
Es*:												
Eram	0-8	27-40	1.30-1.60	0.2-0.6	0.15-0.19	5.6-6.5	<2	Moderate	0.37	3	7	1-3
	8-26	35-55	1.45-1.75	0.06-0.2	0.14-0.18	5.1-7.3	<2	High	0.37			
	26	---	---	---	---	---	---	---	---			
Shidler	0-12	27-35	1.30-1.60	0.6-2.0	0.18-0.22	6.1-8.4	<2	Moderate	0.32	1	4L	1-5
	12	---	---	---	---	---	---	---	---			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cm3	In/hr	In/in	pH	mmhos/cm					Pct
Ge---------------- Gerald	0-13	20-25	1.30-1.50	0.6-2.0	0.15-0.18	4.5-6.0	<2	Low--------	0.43	4	6	.5-2
	13-22	35-45	1.40-1.60	<0.06	0.05-0.10	4.5-5.5	<2	High-------	0.43			
	22-30	25-35	1.60-1.80	<0.06	0.01-0.05	4.5-5.5	<2	Low--------	0.43			
	30-60	35-60	1.40-1.60	0.2-0.6	0.03-0.08	4.5-5.5	<2	Moderate	0.43			
He, Hf------------ Hepler	0-23	12-27	1.25-1.35	0.6-2.0	0.22-0.24	4.5-6.5	<2	Low--------	0.37	5	6	.5-1
	23-60	27-35	1.35-1.45	0.6-2.0	0.18-0.20	4.5-6.5	<2	Moderate	0.37			
Ka, Kn------------ Kanima	0-6	27-35	1.30-1.60	0.6-2.0	0.08-0.17	5.6-8.4	<2	Low--------	0.28	4	---	.5-2
	6-60	18-35	1.40-1.70	0.6-2.0	0.02-0.12	5.6-8.4	<2	Low--------	0.28			
Ln---------------- Lanton	0-7	20-30	1.30-1.55	0.6-2.0	0.18-0.22	6.1-7.3	<2	Low--------	0.37	5	6	2-6
	7-39	20-35	1.40-1.60	0.2-0.6	0.17-0.22	6.1-7.3	<2	Low--------	0.43			
	39-60	30-50	1.40-1.60	0.06-0.6	0.12-0.18	6.1-7.3	<2	Moderate	0.32			
Ns---------------- Nixa	0-5	5-25	1.30-1.60	0.6-2.0	0.08-0.10	4.5-5.5	<2	Low--------	0.32	2	8	1-3
	5-18	20-35	1.30-1.60	0.2-0.6	0.08-0.10	4.5-5.5	<2	Low--------	0.43			
	18-60	20-35	1.40-1.80	<0.06	0.05-0.08	4.5-5.5	<2	Low--------	0.43			
Os---------------- Osage	0-17	40-50	1.40-1.60	<0.06	0.12-0.14	5.1-7.8	<2	Very high	0.28	5	4	1-4
	17-60	35-60	1.50-1.70	<0.06	0.08-0.12	5.6-7.8	<2	Very high	0.28			
Pr---------------- Parsons	0-14	15-25	1.30-1.50	0.6-2.0	0.16-0.24	5.1-6.5	<2	Low--------	0.43	4	6	.5-1
	14-60	35-60	1.40-1.70	<0.6	0.14-0.22	5.1-7.8	<2	High-------	0.43			
Se, Sf------------ Secesh	0-10	15-25	1.10-1.30	0.6-2.0	0.16-0.20	5.1-6.5	<2	Low--------	0.32	3	5	<2
	10-25	20-30	1.20-1.40	0.6-2.0	0.13-0.19	4.5-6.0	<2	Low--------	0.32			
	25-60	25-35	1.30-1.50	2.0-6.0	0.03-0.08	4.5-6.0	<2	Low--------	0.24			
To---------------- Taloka	0-21	15-25	1.30-1.50	0.6-2.0	0.16-0.24	5.1-6.0	<2	Low--------	0.43	5	6	.5-1
	21-60	35-60	1.40-1.70	<0.06	0.12-0.22	5.1-8.4	<2	High-------	0.43			
Tt---------------- Tonti	0-9	18-27	1.20-1.30	0.6-2.0	0.15-0.20	4.5-5.5	<2	Low--------	0.37	3	6	.5-1
	9-19	18-35	1.25-1.35	0.6-2.0	0.14-0.19	4.5-5.5	<2	Low--------	0.32			
	19-60	28-35	1.40-1.60	0.06-0.2	0.05-0.10	4.5-5.5	<2	Low--------	0.32			
Vb---------------- Verdigris	0-7	15-27	1.30-1.40	0.6-2.0	0.20-0.24	5.6-7.3	<2	Low--------	0.32	5	6	2-4
	7-60	18-35	1.40-1.65	0.6-2.0	0.17-0.22	5.6-7.3	<2	Moderate	0.32			
Wa---------------- Waben	0-18	15-27	1.20-1.50	2.0-6.0	0.05-0.15	5.1-6.5	<2	Low--------	0.24	5	8	.5-2
	18-60	20-35	1.30-1.60	2.0-6.0	0.05-0.15	5.1-6.5	<2	Low--------	0.24			
Za---------------- Zaar	0-15	40-60	1.20-1.30	<0.06	0.12-0.14	5.6-7.3	<2	High-------	0.28	5	4	2-4
	15-52	40-60	1.35-1.50	<0.06	0.11-0.18	6.1-8.4	<2	High-------	0.28			
	52-60	35-50	1.35-1.50	<0.06	0.10-0.18	6.6-8.4	<2	High-------	0.28			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
Be, Bf------------- Bates	B	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	Moderate.
Bh*:											
Bates-------------	B	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	Moderate.
Collinsville------	C	None---------	---	---	>6.0	---	---	4-20	Hard	Low-------	Moderate.
Bo*:											
Bolivar-----------	B	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	Moderate.
Hector------------	D	None---------	---	---	>6.0	---	---	10-20	Hard	Low-------	Moderate.
Br----------------- Brazilton	D	None---------	---	---	>6.0	---	---	>60	---	High------	Moderate.
Cd----------------- Catoosa	B	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate.
Ce----------------- Cherokee	D	None---------	---	---	0-1.0	Perched	Dec-Jun	>60	---	High------	Moderate.
Ck----------------- Clarksville	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	High.
Db----------------- Dennis	C	None---------	---	---	2.0-3.0	Perched	Dec-Apr	>60	---	High------	Moderate.
Du*. Dumps											
En----------------- Eram	C	None---------	---	---	2.0-3.0	Perched	Dec-Apr	20-40	Soft	High------	Moderate.
Es*:											
Eram--------------	C	None---------	---	---	2.0-3.0	Perched	Dec-Apr	20-40	Soft	High------	Moderate.
Shidler-----------	D	None---------	---	---	>6.0	---	---	4-20	Hard	Moderate	Low.
Ge----------------- Gerald	D	None---------	---	---	1.0-2.0	Perched	Dec-Apr	>60	---	High------	High.
He----------------- Hepler	C	Occasional	Brief------	Mar-Jul	1.0-3.0	Apparent	Nov-Mar	>60	---	High------	Moderate.
Hf----------------- Hepler	C	Frequent----	Brief------	Mar-Jul	1.0-3.0	Apparent	Nov-Mar	>60	---	High------	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
Ka, Kn------------ Kanima	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
Ln---------------- Lanton	D	Occasional	Very brief	Jan-May	1.0-2.0	Apparent	Dec-May	>60	---	High-----	Low.
Ns---------------- Nixa	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Os---------------- Osage	D	Occasional	Very brief to long.	Nov-May	0-1.0	Apparent	Nov-May	>60	---	High-----	Moderate.
Pr---------------- Parsons	D	None--------	---	---	0.5-1.5	Perched	Dec-Apr	>60	---	High-----	Moderate.
Se---------------- Secesh	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
Sf---------------- Secesh	B	Frequent----	Very brief	Nov-Apr	>6.0	---	---	>60	---	Low------	Moderate.
To---------------- Taloka	D	None--------	---	---	1.0-2.0	Perched	Mar-Jun	>60	---	High-----	Moderate.
Tt---------------- Tonti	C	None--------	---	---	>6.0	---	---	>60	---	High-----	High.
Vb---------------- Verdigris	B	Occasional	Very brief	Dec-Jun	>6.0	---	---	>60	---	Low------	Low.
Wa---------------- Waben	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
Za---------------- Zaar	D	None--------	---	---	1.0-2.0	Perched	Dec-Apr	>60	---	High-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--ENGINEERING INDEX TEST DATA

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution							Liquid limit	Plasticity index	Moisture density	
			Percentage passing sieve--				Percentage smaller than--						
	AASHTO	Unified	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			Max. dry density	Optimum moisture
										Pct		Lb/ft3	Pct
Cherokee silt loam: (S83KS-021-021)													
E-------- 8 to 15	A-4	ML	100	100	99	95	51	8	2	24	2	105	14
Btgl----- 15 to 28	A-7	CL	100	100	99	97	77	48	37	49	21	90	27
Cg------- 38 to 60	A-6	CL	100	100	99	96	64	28	16	34	16	106	18
Hepler silt loam: (S83KS-021-023)													
E2------- 18 to 30	A-4	CL	100	100	98	94	64	22	13	29	7	104	17
Bt1------ 30 to 40	A-6	CL	100	100	99	95	71	37	26	36	15	103	17
BC------- 50 to 60	A-6	CL	100	100	98	90	65	28	16	31	14	108	16
Kanima shaly silty clay loam: (S83KS-021-024)													
A-------- 0 to 6	A-6	CH, CL	100	100	88	74	60	37	22	40	16	109	16
C-------- 36 to 46	A-6	CH, CL	100	100	72	52	42	27	15	36	13	118	15
Taloka silt loam: (S83KS-021-022)													
E1------- 8 to 14	A-4	ML	100	100	98	84	49	14	6	34	9	99	19
Btgl----- 21 to 34	A-7	MH	100	100	100	94	76	54	45	51	21	89	29
Btg3----- 45 to 60	A-6	CL	100	100	96	86	64	39	29	38	18	104	20

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Bates	Fine-loamy, siliceous, thermic Typic Argiudolls
Bolivar	Fine-loamy, mixed, thermic Ultic Hapludalfs
Brazilton	Fine, mixed, nonacid, thermic Hapludollic Arents
Catoosa	Fine-silty, mixed, thermic Typic Argiudolls
Cherokee	Fine, mixed, thermic Typic Albaqualfs
Clarksville	Loamy-skeletal, siliceous, mesic Typic Paleudults
Collinsville	Loamy, siliceous, thermic Lithic Hapludolls
Dennis	Fine, mixed, thermic Aquic Paleudolls
Eram	Fine, mixed, thermic Aquic Argiudolls
Gerald	Fine, mixed, mesic Umbric Fragiaqualfs
Hector	Loamy, siliceous, thermic Lithic Dystrochrepts
Hepler	Fine-silty, mixed, thermic Udollic Ochraqualfs
Kanima	Loamy-skeletal, mixed, nonacid, thermic Udalfic Arents
Lanton	Fine-silty, mixed, thermic Cumulic Haplaquolls
Nixa	Loamy-skeletal, siliceous, mesic Glossic Fragiudults
Osage	Fine, montmorillonitic, thermic Vertic Haplaquolls
Parsons	Fine, mixed, thermic Mollic Albaqualfs
Secesh	Fine-loamy, siliceous, mesic Ultic Hapludalfs
Shidler	Loamy, mixed, thermic Lithic Haplustolls
Taloka	Fine, mixed, thermic Mollic Albaqualfs
Tonti	Fine-loamy, mixed, mesic Typic Fragiudults
Verdigris	Fine-silty, mixed, thermic Cumulic Hapludolls
Waben	Loamy-skeletal, siliceous, mesic Ultic Hapludalfs
Zaar	Fine, montmorillonitic, thermic Vertic Hapludolls

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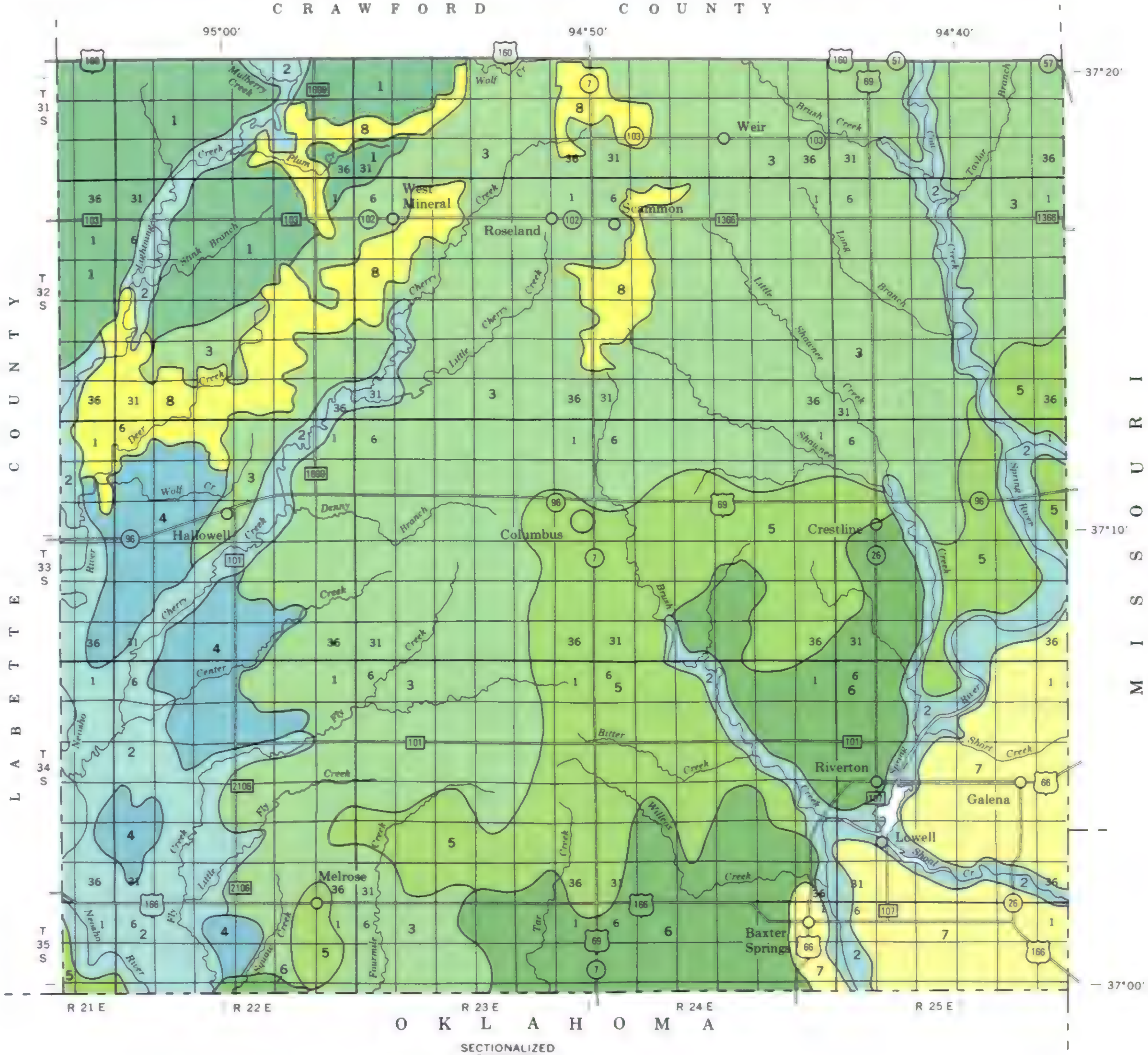


SOIL LEGEND*

1 — PARSONS-ZAAR-CATOOSA association: Deep and moderately deep, nearly level, somewhat poorly drained and well drained, silty and clayey soils; on uplands

2 — HEPLER-OSAGE association: Deep, nearly level, somewhat poorly drained and poorly drained, silty and clayey soils; on terraces and flood plains

3 — PARSONS-DENNIS association: Deep, nearly level and gently sloping, somewhat poorly drained and moderately well drained, silty soils; on uplands

4 — CHEROKEE-HEPLER association: Deep, nearly level, somewhat poorly drained, silty soils; on uplands, terraces, and flood plains

5 — DENNIS-BATES-PARSONS association: Deep and moderately deep, nearly level to moderately sloping, well drained to somewhat poorly drained, silty and loamy soils; on uplands

6 — TALOKA-DENNIS association: Deep, nearly level and gently sloping, somewhat poorly drained and moderately well drained, silty soils; on uplands

7 — CLARKSVILLE-NIXA-TONTI association: Deep, gently sloping to moderately steep, somewhat excessively drained and moderately well drained, cherty and silty soils; on uplands

8 — KANIMA association: Deep, moderately sloping to steep, well drained, shaly and silty soils; on uplands

*Texture terms in the descriptive headings refer to the surface layer of the major soils in the associations.

Compiled 1984

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
KANSAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

CHEROKEE COUNTY, KANSAS

Scale 1:190,080

1 0 1 2 3 Miles

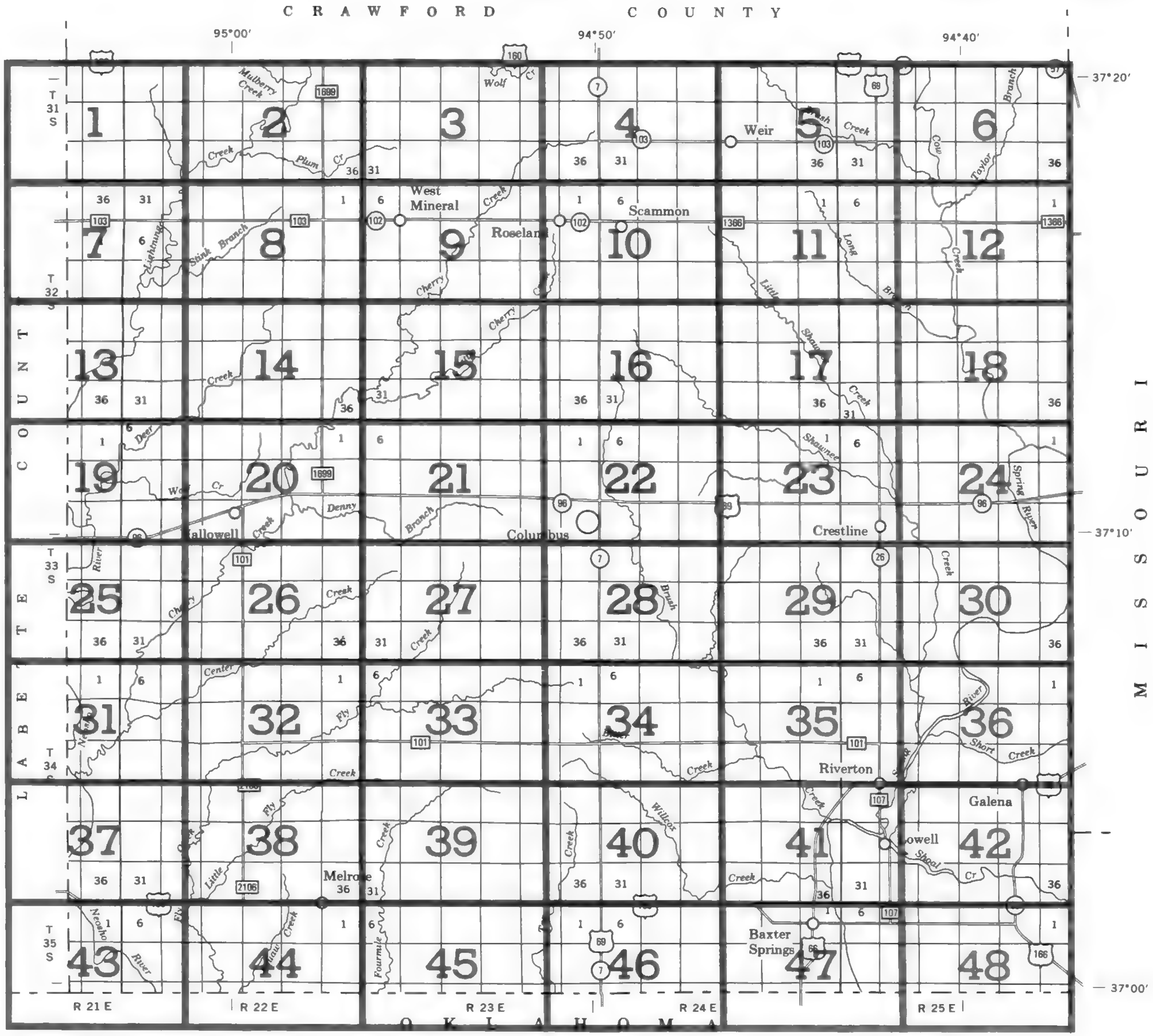
1 0 3 6 Km

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

N

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

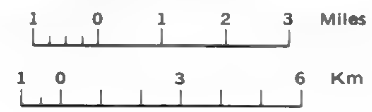


SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS
CHEROKEE COUNTY, KANSAS

Scale 1:190,080



SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 following the slope letter indicates that the soil is moderately eroded.

SYMBOL	NAME
6	Okoboji silty clay loam, 0 to 1 percent slopes
28B	Dickman sandy loam, 2 to 7 percent slopes
55	Nicollet loam, 1 to 3 percent slopes
62C2	Storden loam, 5 to 9 percent slopes, moderately eroded
62D2	Storden loam, 9 to 14 percent slopes, moderately eroded
62E2	Storden loam, 14 to 20 percent slopes, moderately eroded
73B	Salida gravelly sandy loam, 2 to 7 percent slopes
73E	Salida gravelly sandy loam, 9 to 18 percent slopes
90	Okoboji mucky silt loam, 0 to 1 percent slopes
95	Harps loam, 1 to 3 percent slopes
107	Webster clay loam, 0 to 2 percent slopes
135	Coland clay loam, 0 to 2 percent slopes
135B	Coland clay loam, 2 to 5 percent slopes
138B	Clarion loam, 2 to 5 percent slopes
138C	Clarion loam, 5 to 9 percent slopes
138C2	Clarion loam, 5 to 9 percent slopes, moderately eroded
138D2	Clarion loam, 9 to 14 percent slopes, moderately eroded
150	Hanska loam, 0 to 2 percent slopes
168B	Hayden loam, 2 to 5 percent slopes
168C	Hayden loam, 5 to 9 percent slopes
168D2	Hayden loam, 9 to 14 percent slopes, moderately eroded
168E	Hayden loam, 14 to 25 percent slopes
175B	Dickinson fine sandy loam, 2 to 5 percent slopes
221	Palms muck, 0 to 1 percent slopes
224	Linder loam, 0 to 2 percent slopes
236B	Lester loam, 2 to 5 percent slopes
236C2	Lester loam, 5 to 9 percent slopes, moderately eroded
236D2	Lester loam, 9 to 14 percent slopes, moderately eroded
236E2	Lester loam, 14 to 18 percent slopes, moderately eroded
236F	Lester loam, 18 to 30 percent slopes
307	Dundas silt loam, 0 to 2 percent slopes
321	Boots muck, 0 to 1 percent slopes
325	Le Sueur loam, 1 to 3 percent slopes
349	Darfur loam, 0 to 1 percent slopes
384	Collinwood silty clay loam, 0 to 2 percent slopes
384B	Collinwood silty clay loam, 2 to 5 percent slopes
386	Cordova loam, 0 to 2 percent slopes
390	Waldorf silty clay loam, 0 to 2 percent slopes
485B	Spillville loam, 2 to 5 percent slopes
507	Canisteo clay loam, 0 to 2 percent slopes
511	Blue Earth mucky silt loam, 0 to 1 percent slopes
583	Minnetonka silty clay loam, 0 to 2 percent slopes
585B	Coland-Spillville complex, 0 to 5 percent slopes
621	Houghton muck, 0 to 1 percent slopes
638B2	Clarion-Storden loams, 2 to 5 percent slopes, moderately eroded
638C2	Clarion-Storden loams, 5 to 9 percent slopes, moderately eroded
638D2	Clarion-Storden loams, 9 to 14 percent slopes, moderately eroded
638E2	Clarion-Storden loams, 14 to 18 percent slopes, moderately eroded
655	Crippin loam, 1 to 3 percent slopes
658	Mayer loam, 0 to 2 percent slopes
777	Wapsie loam, 0 to 2 percent slopes
777B	Wapsie loam, 2 to 5 percent slopes
777C	Wapsie loam, 5 to 9 percent slopes
787B	Vinje silty clay loam, 2 to 5 percent slopes
787C2	Vinje silty clay loam, 5 to 9 percent slopes, moderately eroded
787D2	Vinje silty clay loam, 9 to 14 percent slopes, moderately eroded
811	Muskego muck, 0 to 1 percent slopes
823	Ridgeport sandy loam, 0 to 2 percent slopes
823B	Ridgeport sandy loam, 2 to 5 percent slopes
836B	Kilkenny clay loam, 2 to 5 percent slopes
836C2	Kilkenny clay loam, 5 to 9 percent slopes, moderately eroded
836D2	Kilkenny clay loam, 9 to 14 percent slopes, moderately eroded
836E2	Kilkenny clay loam, 14 to 18 percent slopes, moderately eroded
836F	Kilkenny clay loam, 18 to 35 percent slopes
855	Shorewood silty clay loam, 1 to 3 percent slopes
1133	Colo silty clay loam, channeled, 0 to 2 percent slopes
2811	Muskego muck, ponded, 0 to 1 percent slopes
5010	Pits, sand and gravel
5040	Orthents, loamy

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, cemetery — Davis Airstrip

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads

ROAD EMBLEMS & DESIGNATIONS

- Federal — 410
- State — 52

RAILROAD

DAMS

- Large (to scale)
- Medium or small — water, w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Crossable with tillage implements
- Not crossable with tillage implements
- Drainage end

Canals or ditches

- Double-line (label) — CANAL
- Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 55 138B

ESCARPMENTS

- Other than bedrock (points down slope)

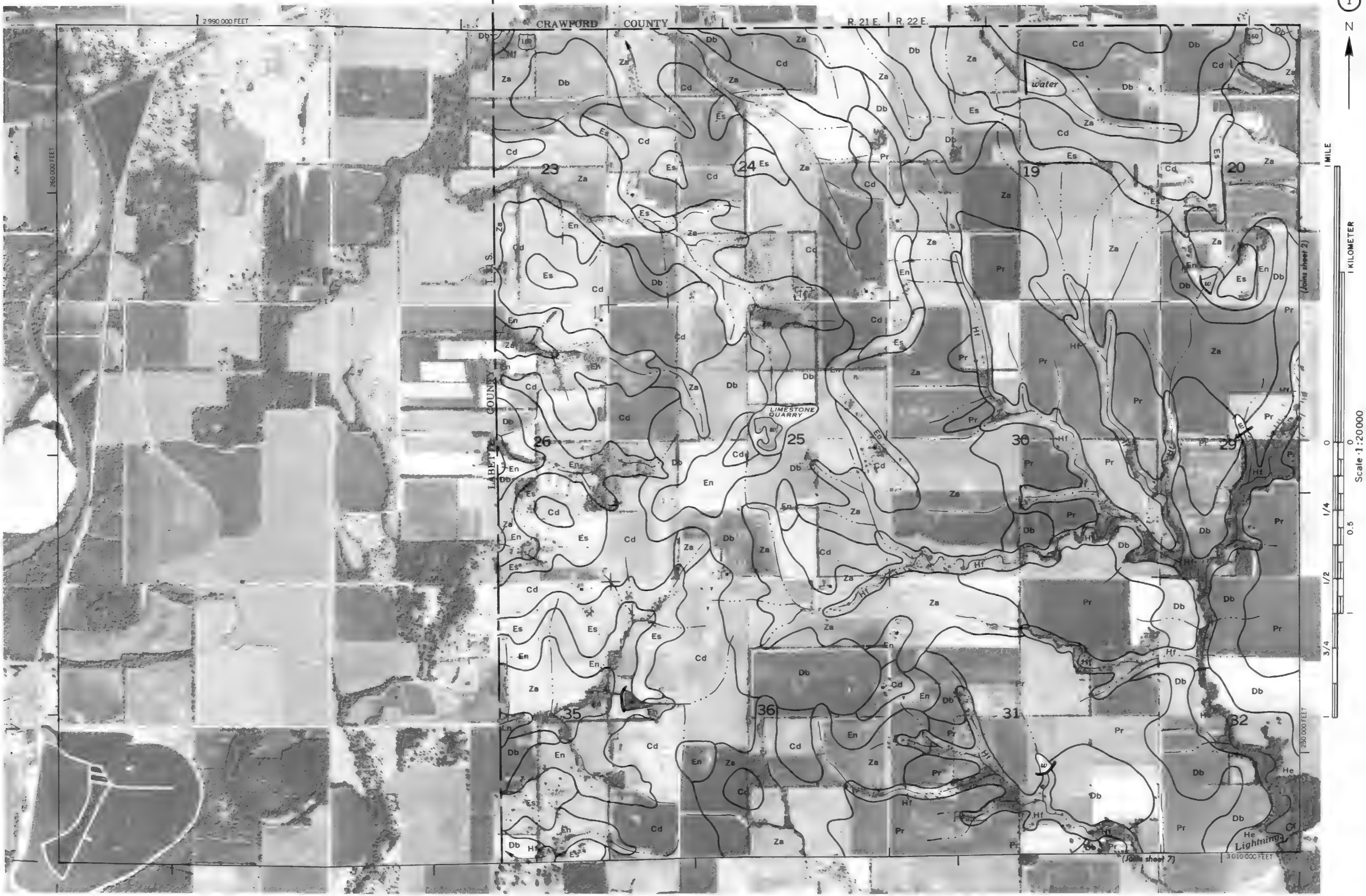
SHORT STEEP SLOPE

SOIL SAMPLE SITE — S

MISCELLANEOUS (each symbol represents 2 acres or less)

- Gravelly spot
- Sandy spot
- Severely eroded spot
- Calcareous spot
- Area of Harps soil
- Area of Okoboji soil
- Area of depressional gray subsurface soil
- Area of Clarion soil
- Area of peat or mucky peat
- Sewage lagoon — S.L

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 1



CHEROKEE COUNTY, KANSAS NO. 1

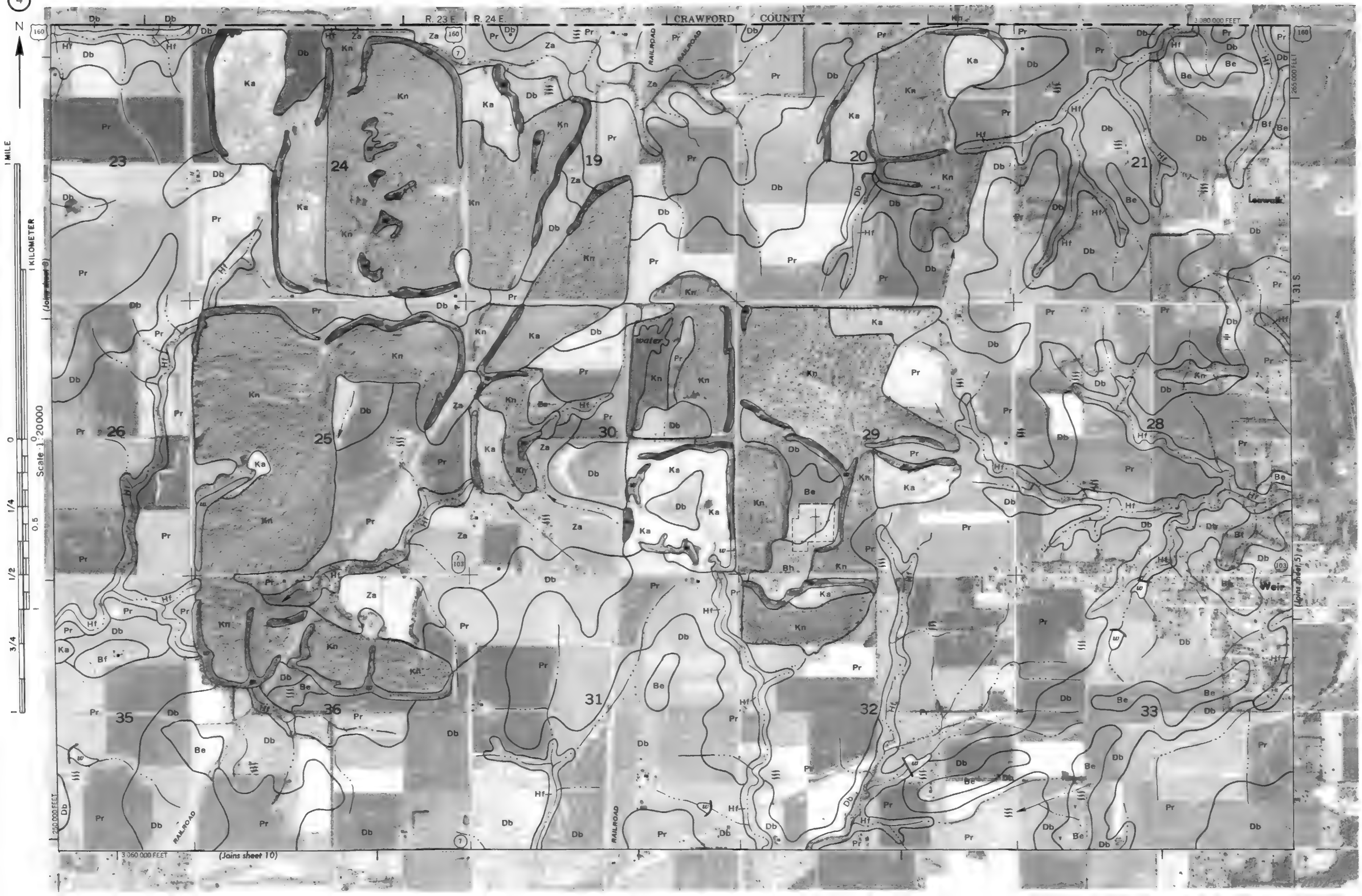
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEROKEE COUNTY, KANSAS NO. 2

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 3

CHEROKEE COUNTY, KANSAS NO. 3

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 4



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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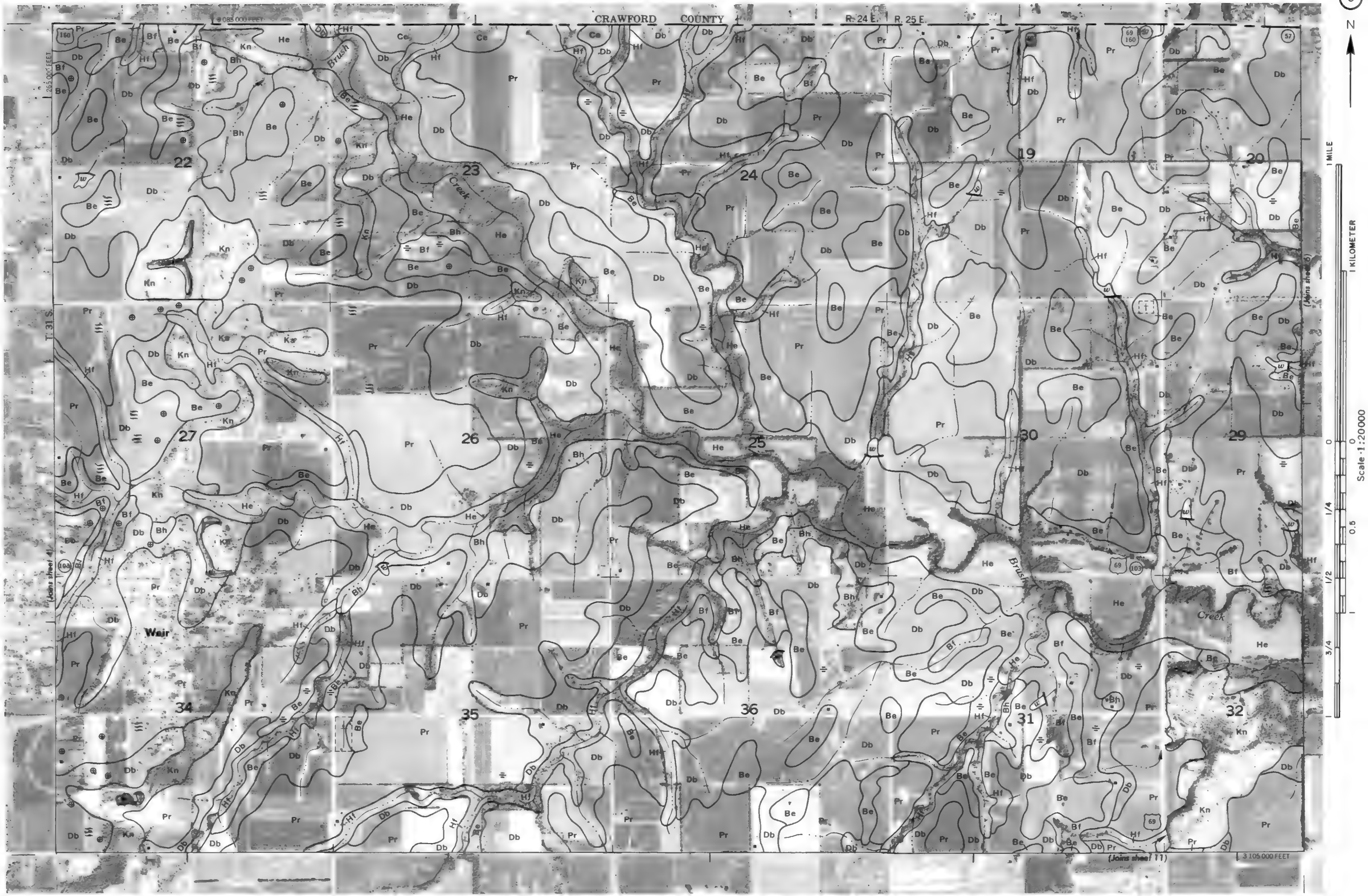
CHEROKEE COUNTY, KANSAS NO. 4

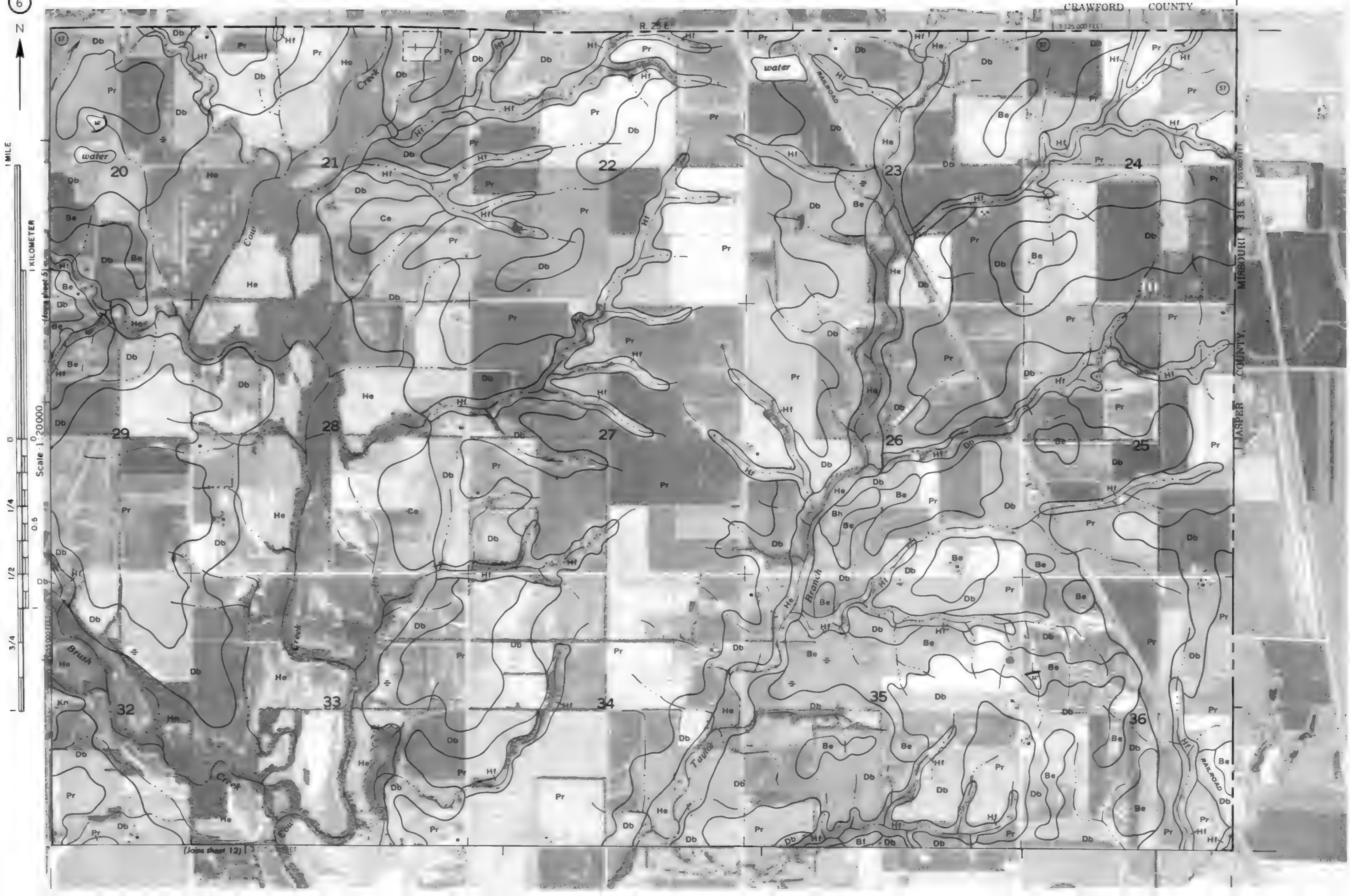
SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 5



CHEROKEE COUNTY, KANSAS NO. 5

This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 6

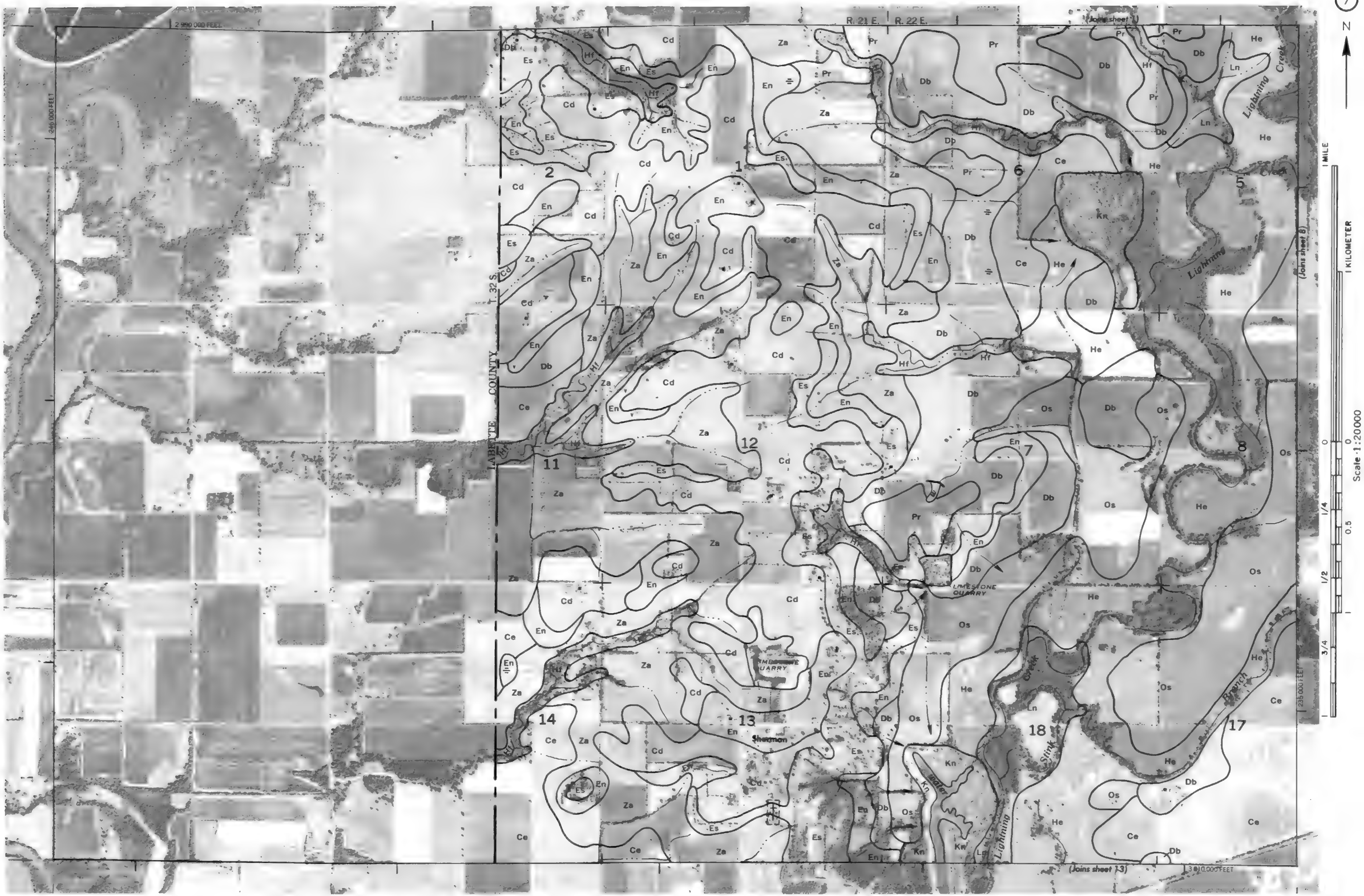


This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEROKEE COUNTY, KANSAS NO. 6

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 7

7



CHEROKEE COUNTY, KANSAS NO. 7

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CHEROKEE COUNTY, KANSAS NO. 8

CHEROKEE COUNTY, KANSAS NO. 9

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SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 10

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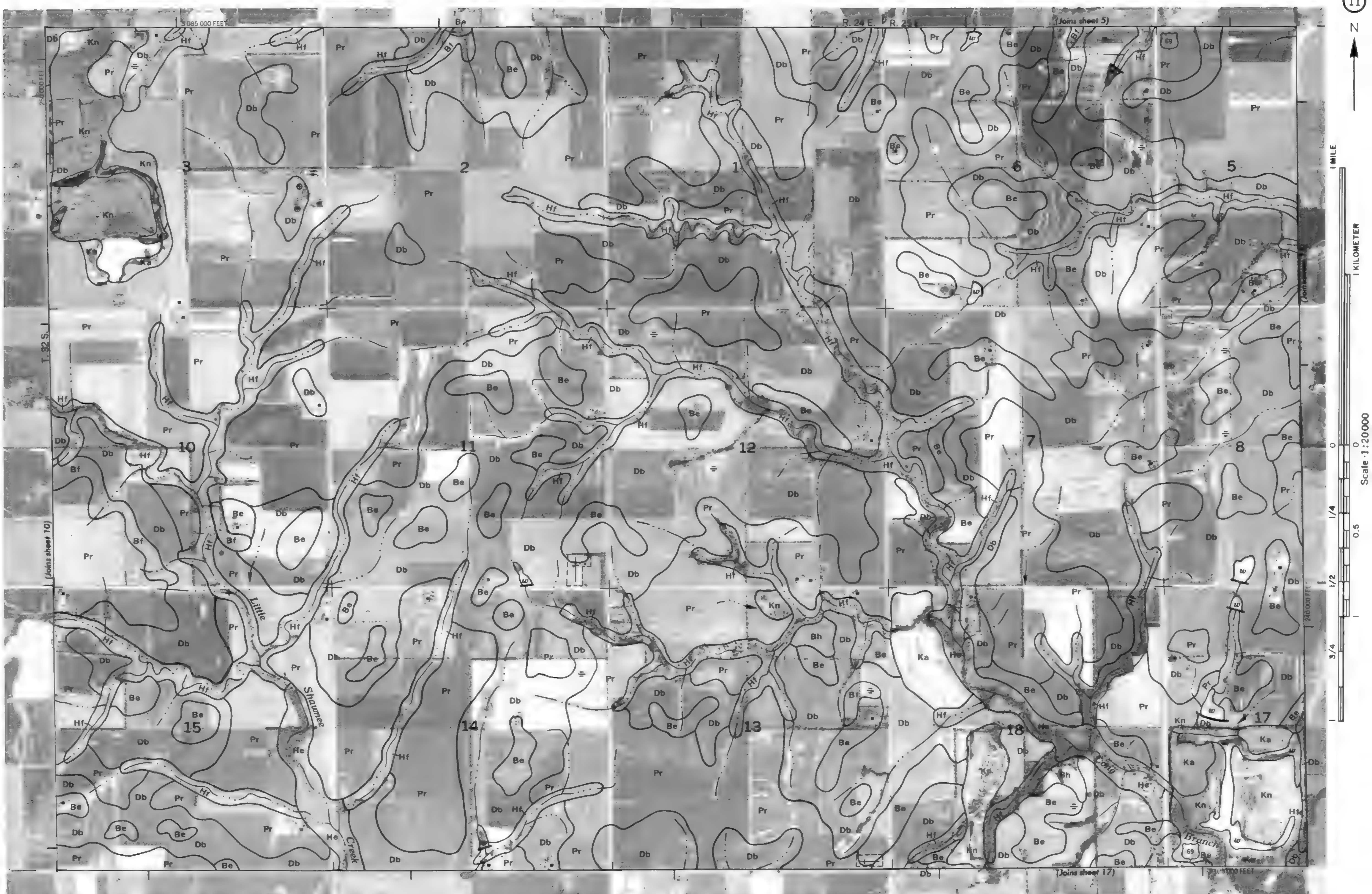
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEROKEE COUNTY, KANSAS NO. 10



CHEROKEE COUNTY, KANSAS NO. 11

This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 12

N

1 MILE

1 KILOMETER

Scale 1:20000

0 1/4 1/2 3/4 1

0 0.5 1

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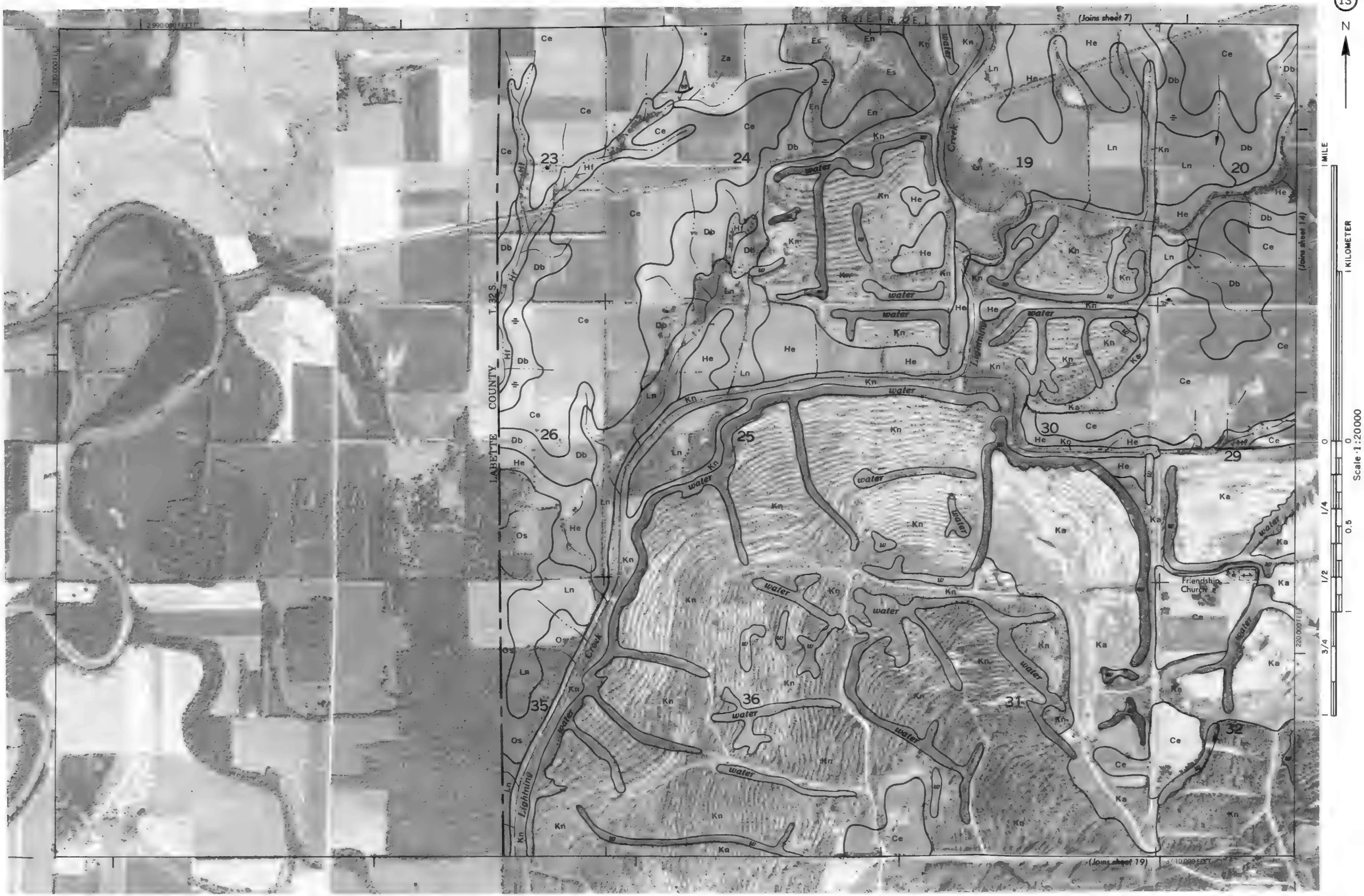
Coordinate grid ticks and land division corners, if shown, are approximately positioned

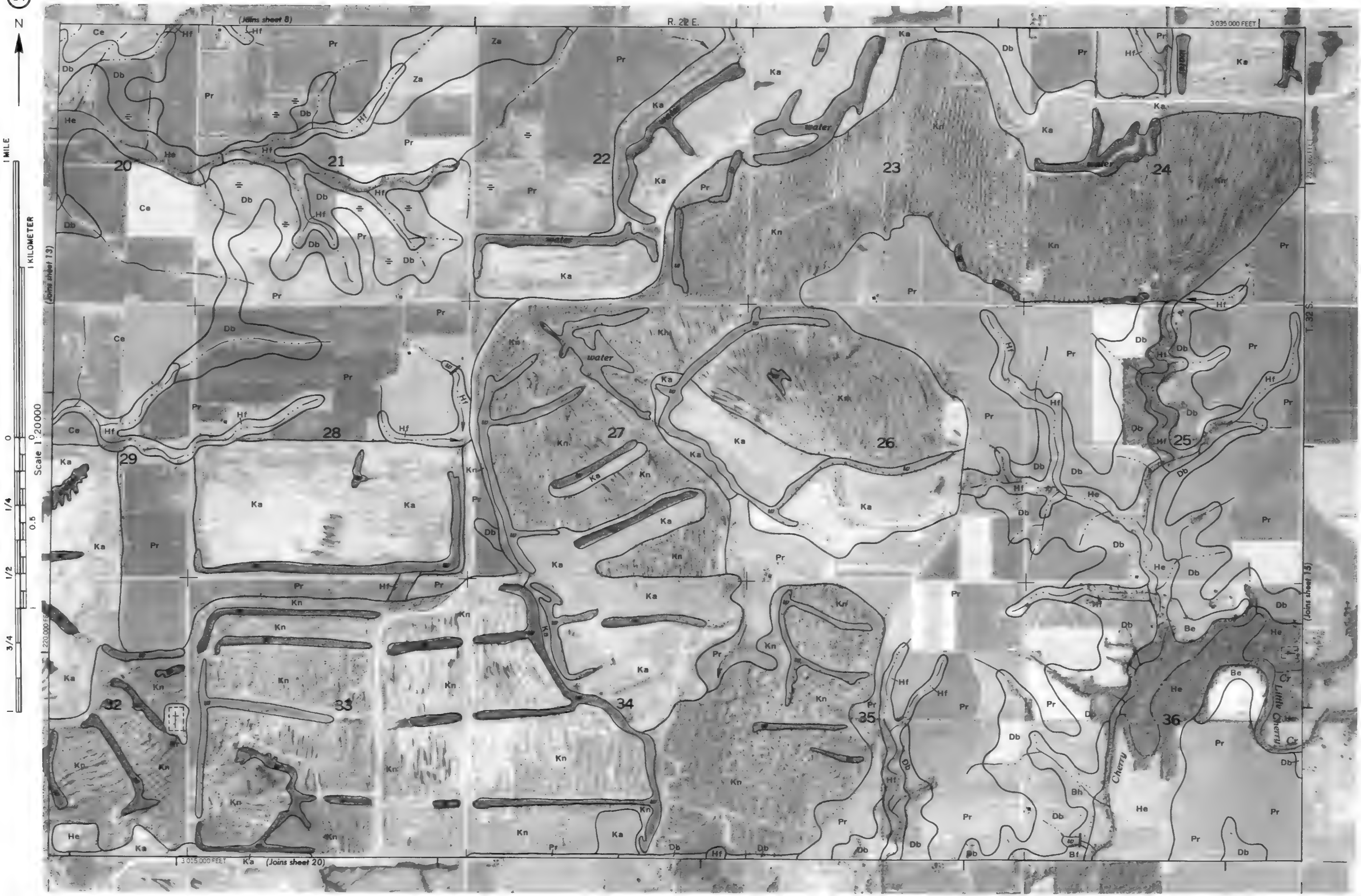


CHEROKEE COUNTY, KANSAS NO. 13

This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

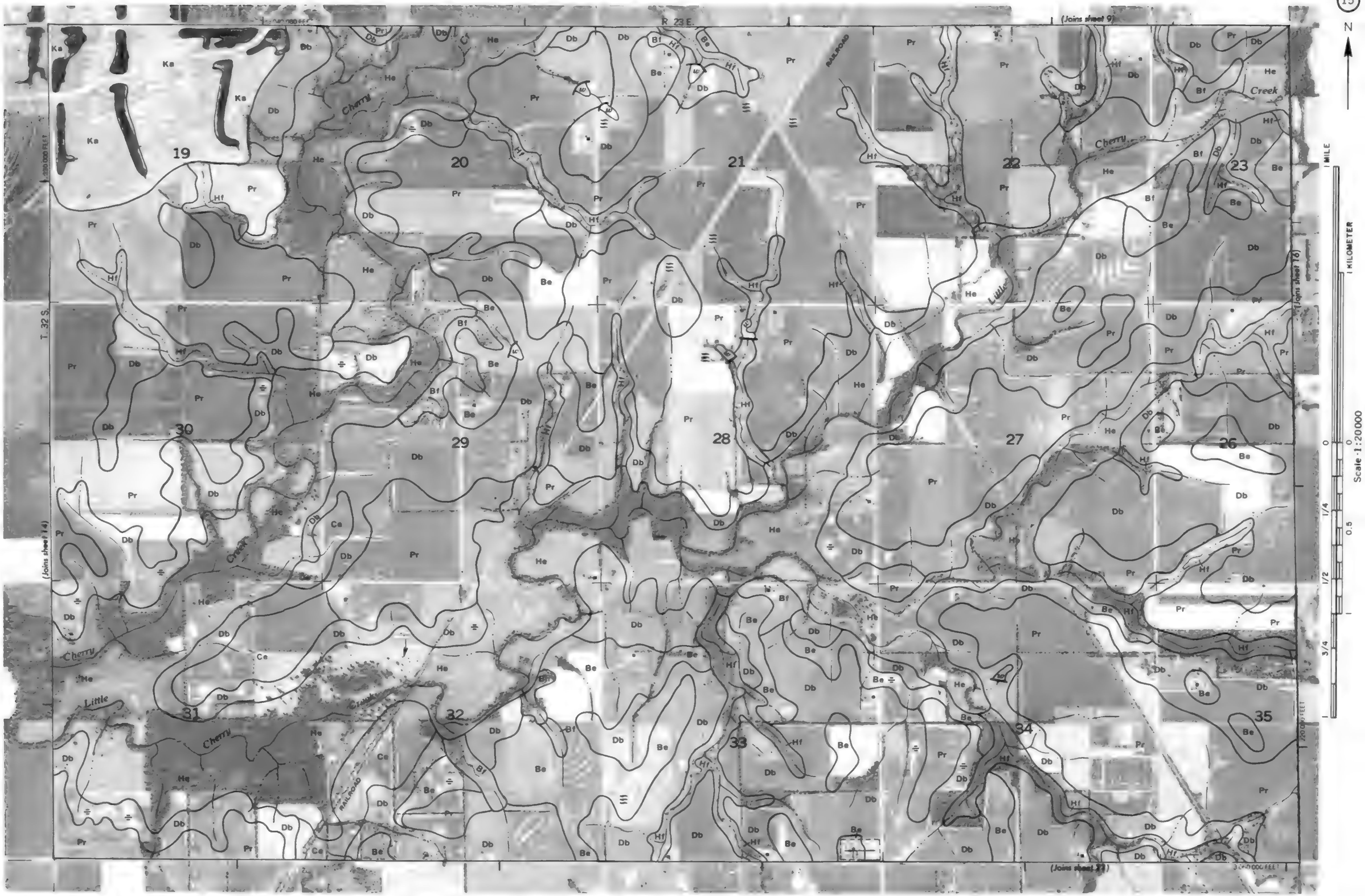
14

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 14



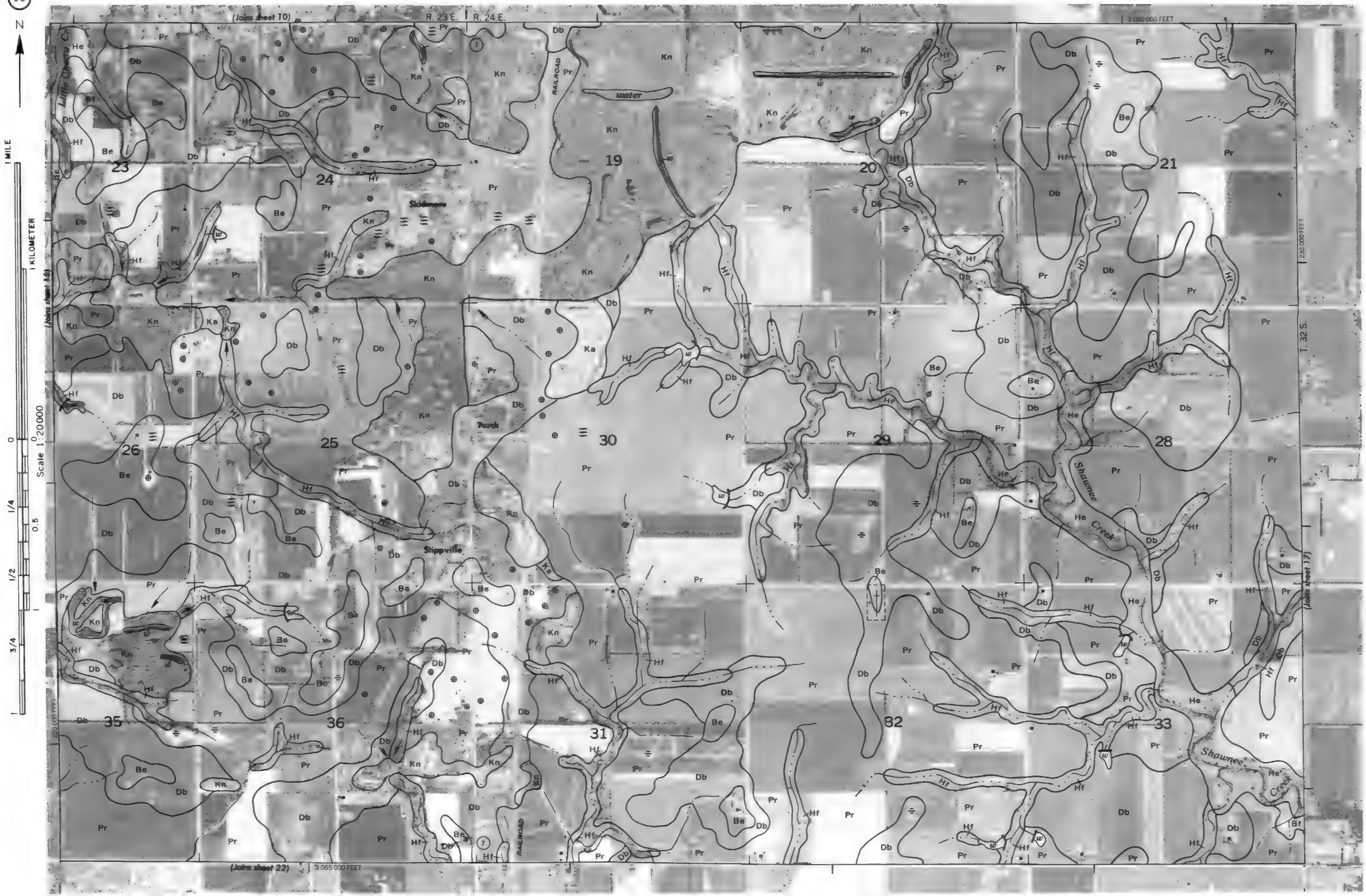
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEROKEE COUNTY, KANSAS NO. 14



CHEROKEE COUNTY, KANSAS NO. 15

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 16

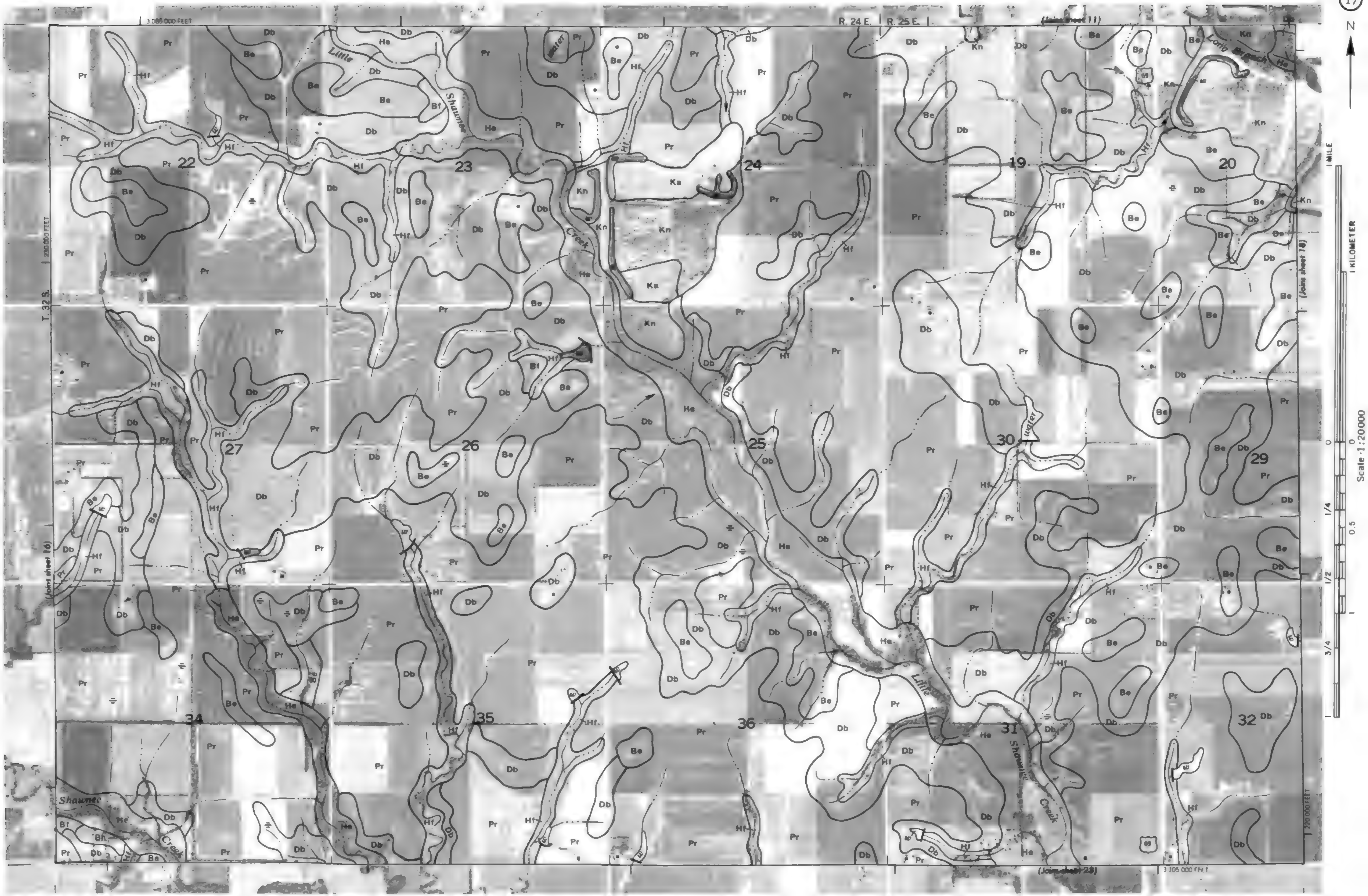


This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

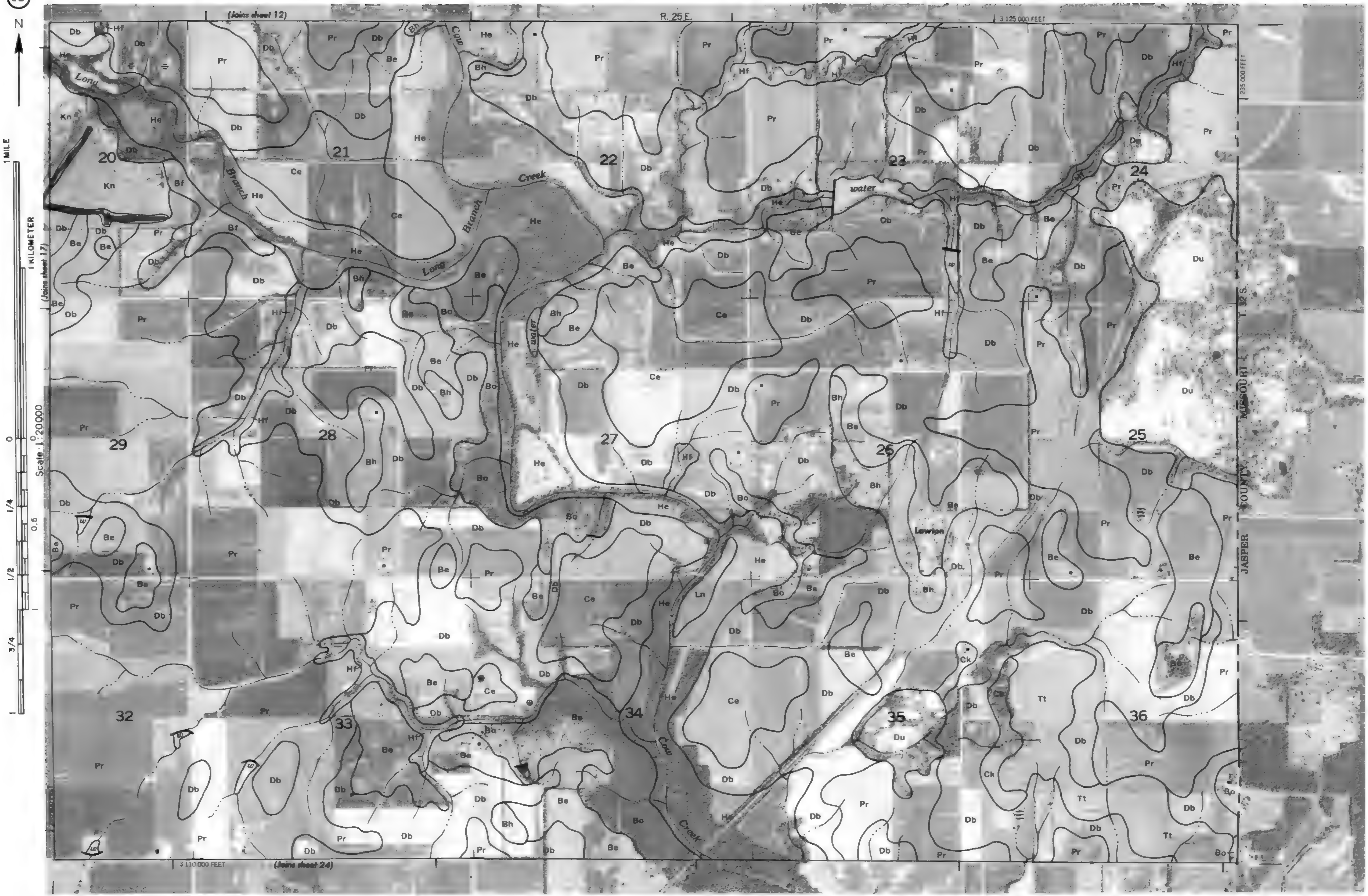
CHEROKEE COUNTY, KANSAS NO. 16

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 17

CHEROKEE COUNTY, KANSAS NO. 17



SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 18



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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CHEROKEE COUNTY, KANSAS NO. 19

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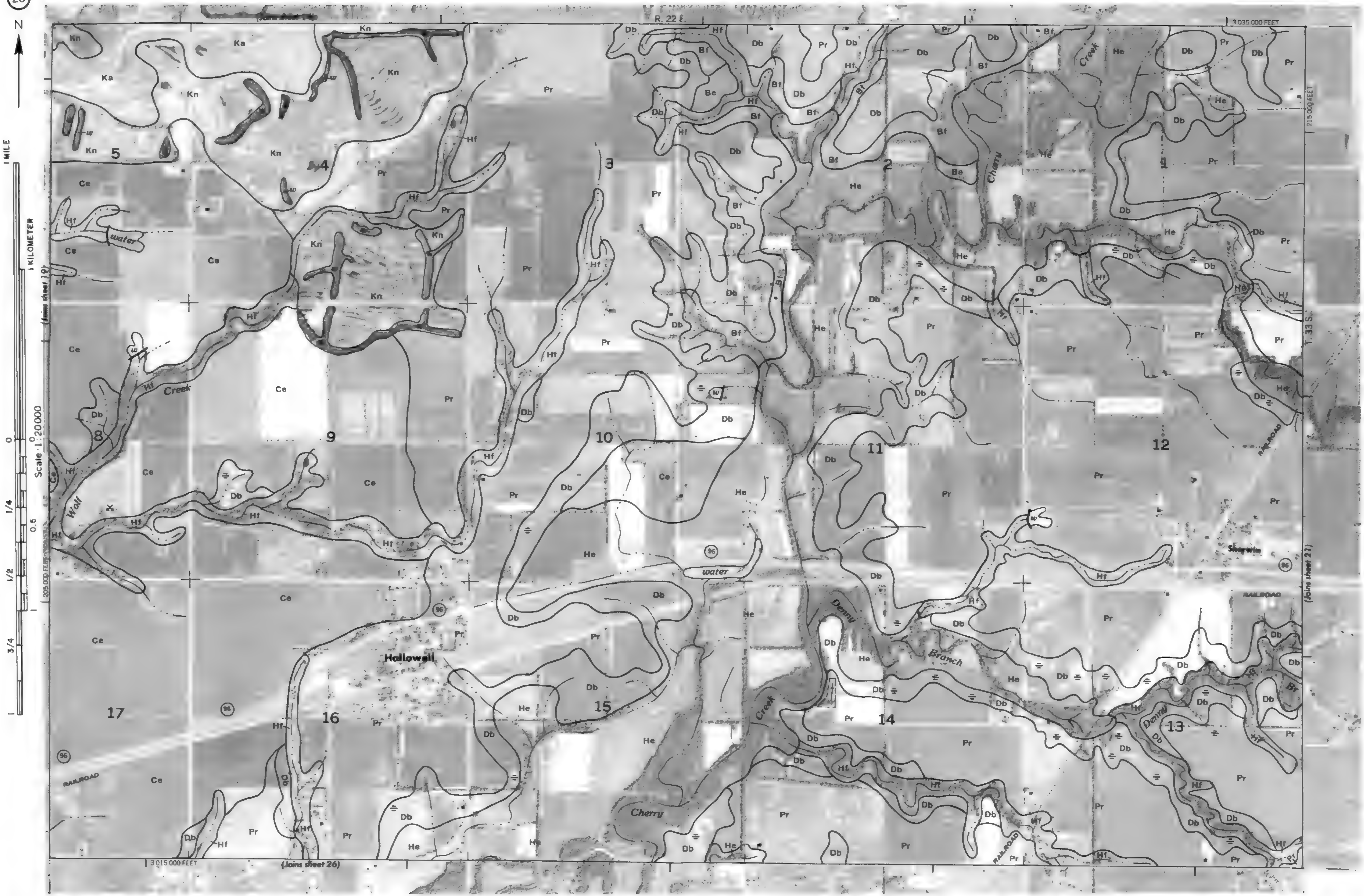
N

1 MILE
1 KILOMETER
0
1/4
1/2
3/4
1
0
0.5
1
Scale 1:20000

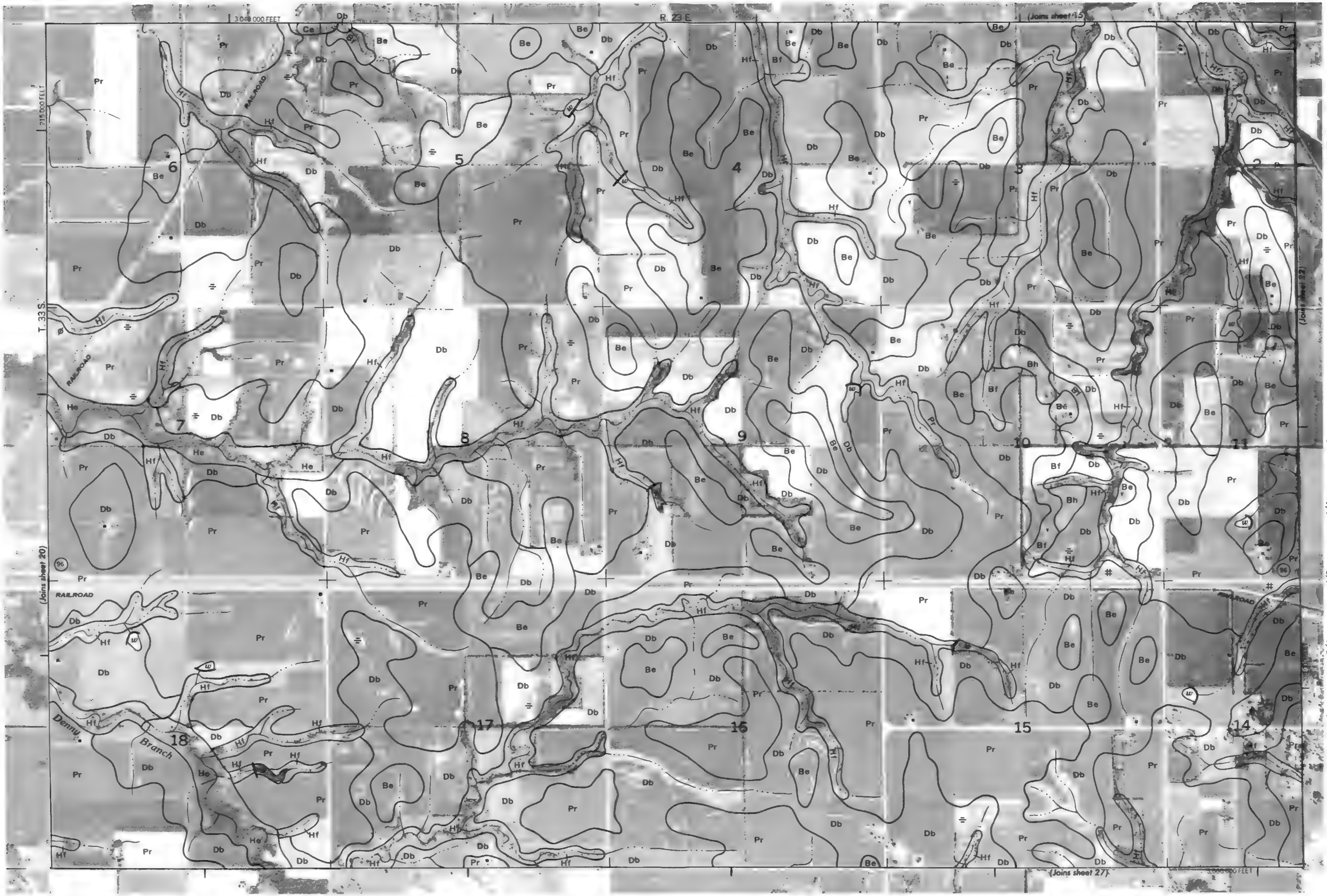
20



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEROKEE COUNTY, KANSAS NO. 20

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 21



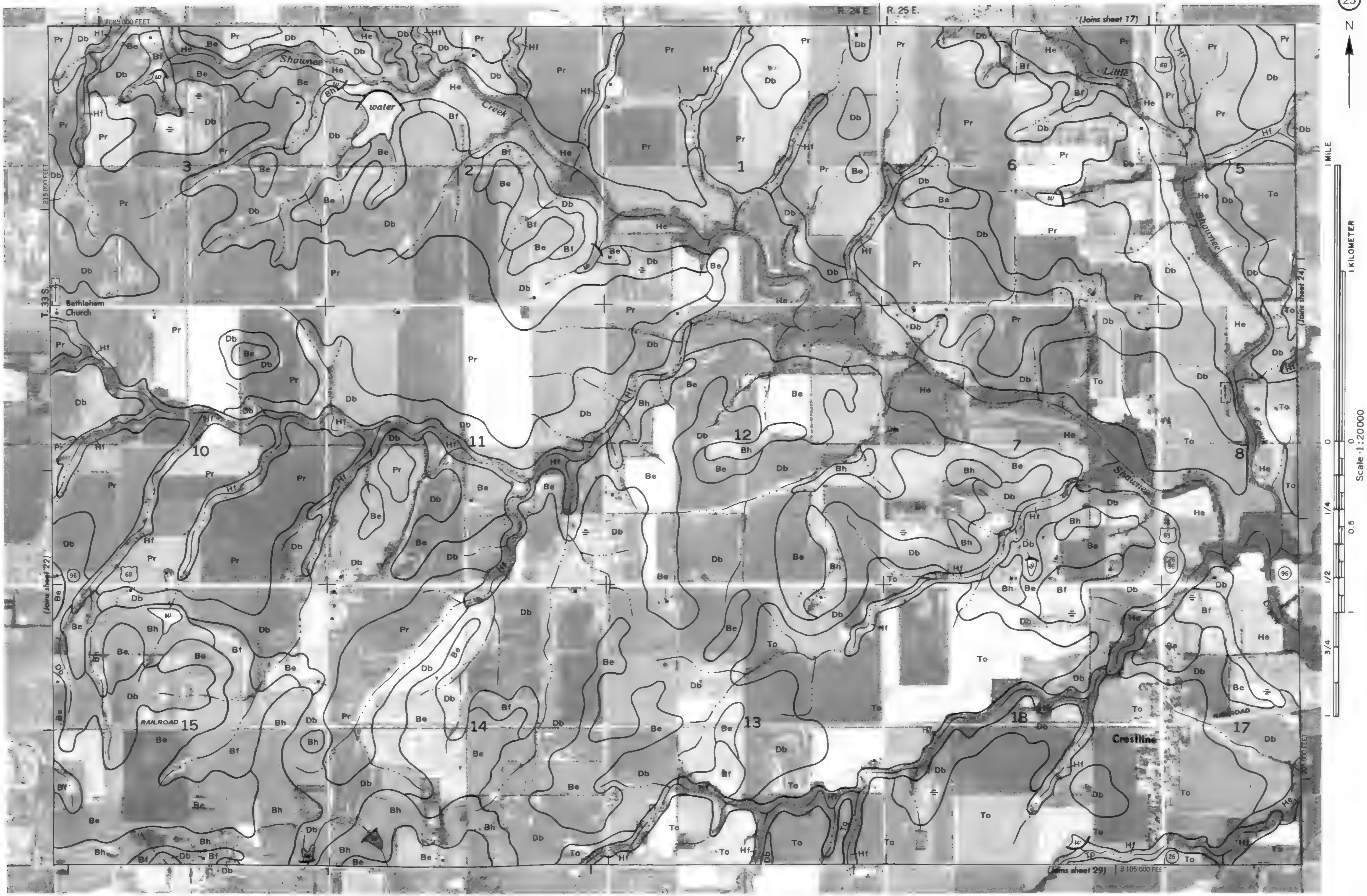
CHEROKEE COUNTY, KANSAS NO. 21

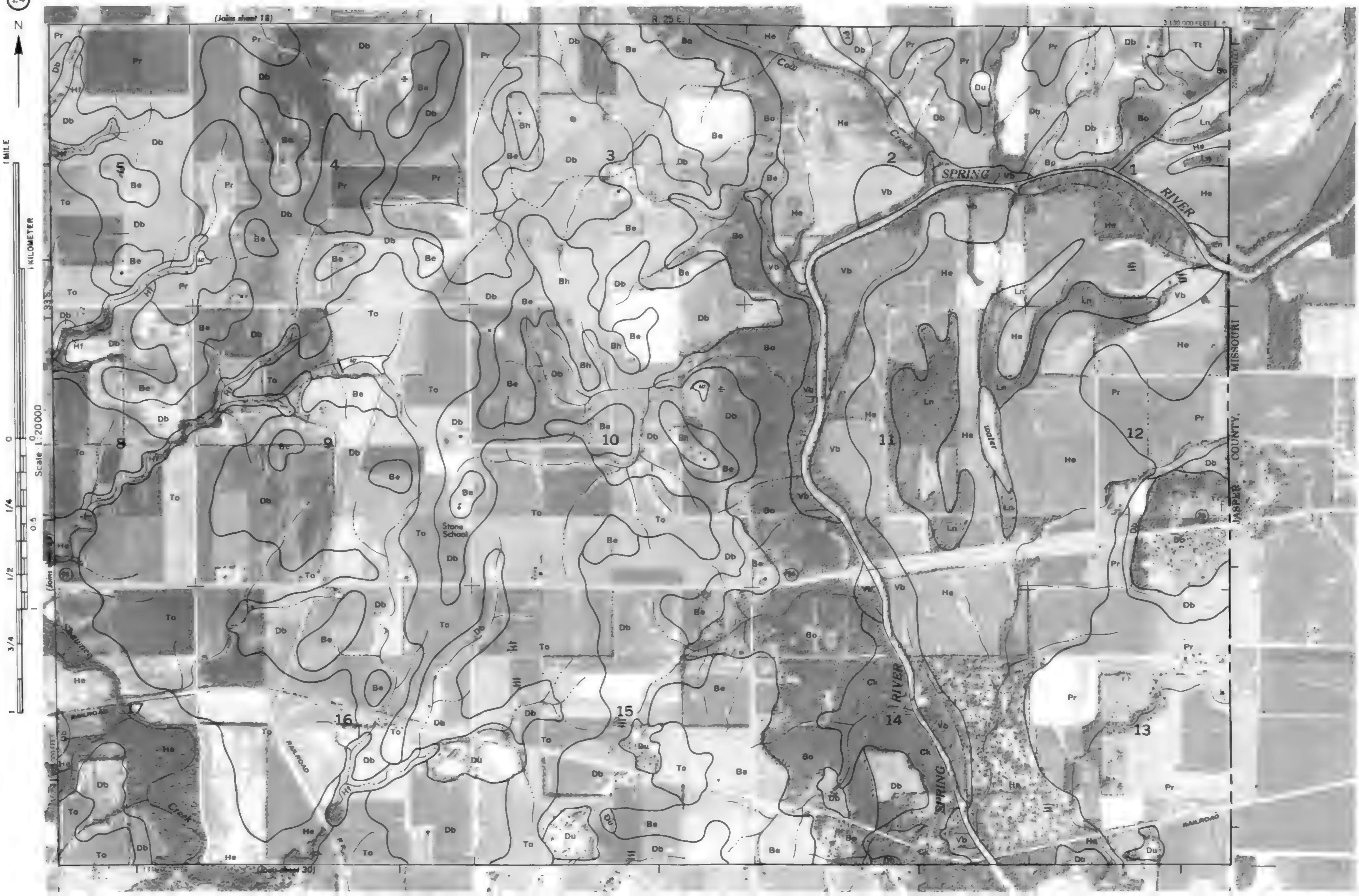
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This soil survey map is compiled on 1979 aerial photography by the U S Department of Agriculture Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners if shown are approximately positioned

CHEROKEE COUNTY, KANSAS NO. 23

This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

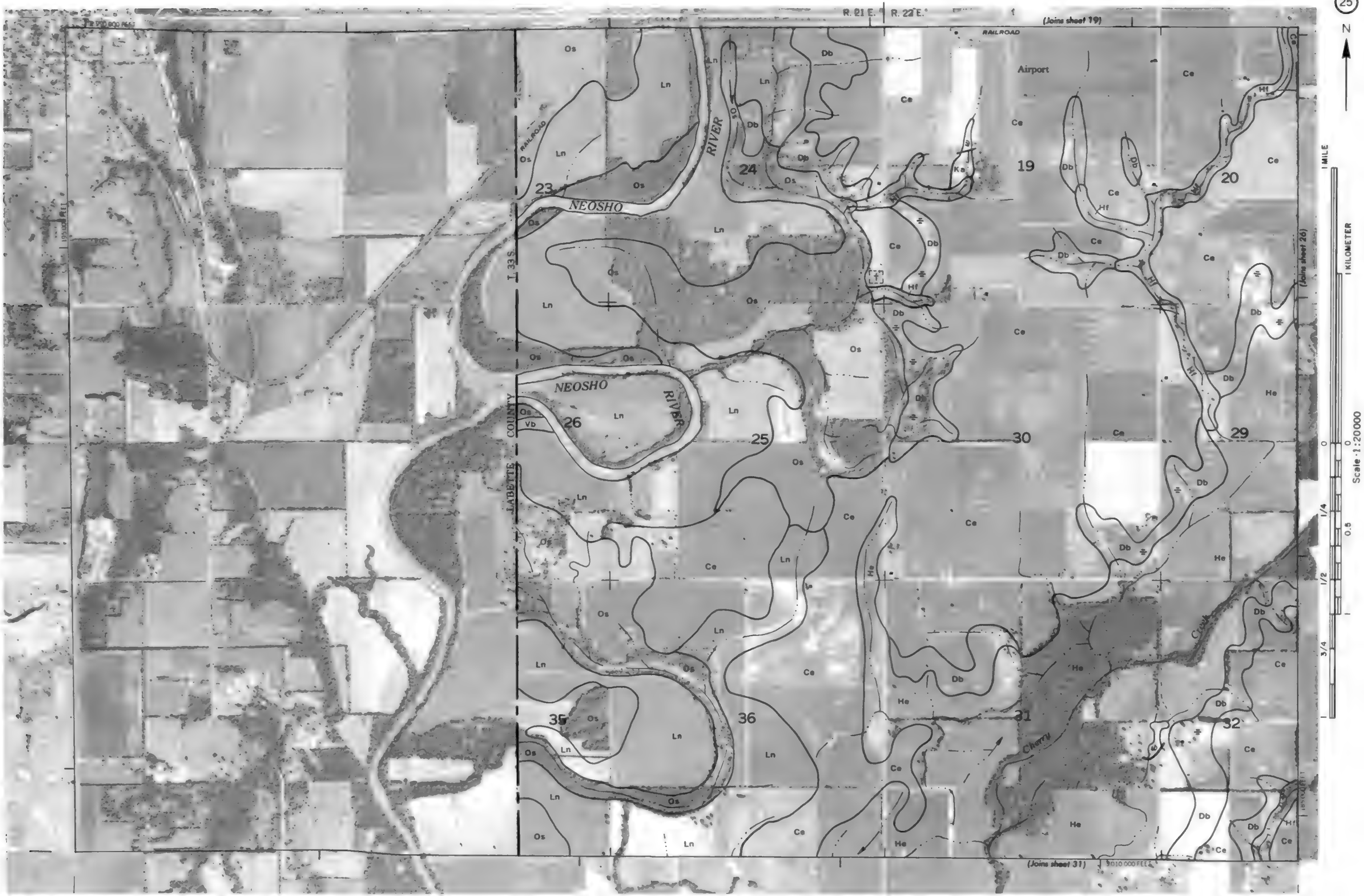




This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

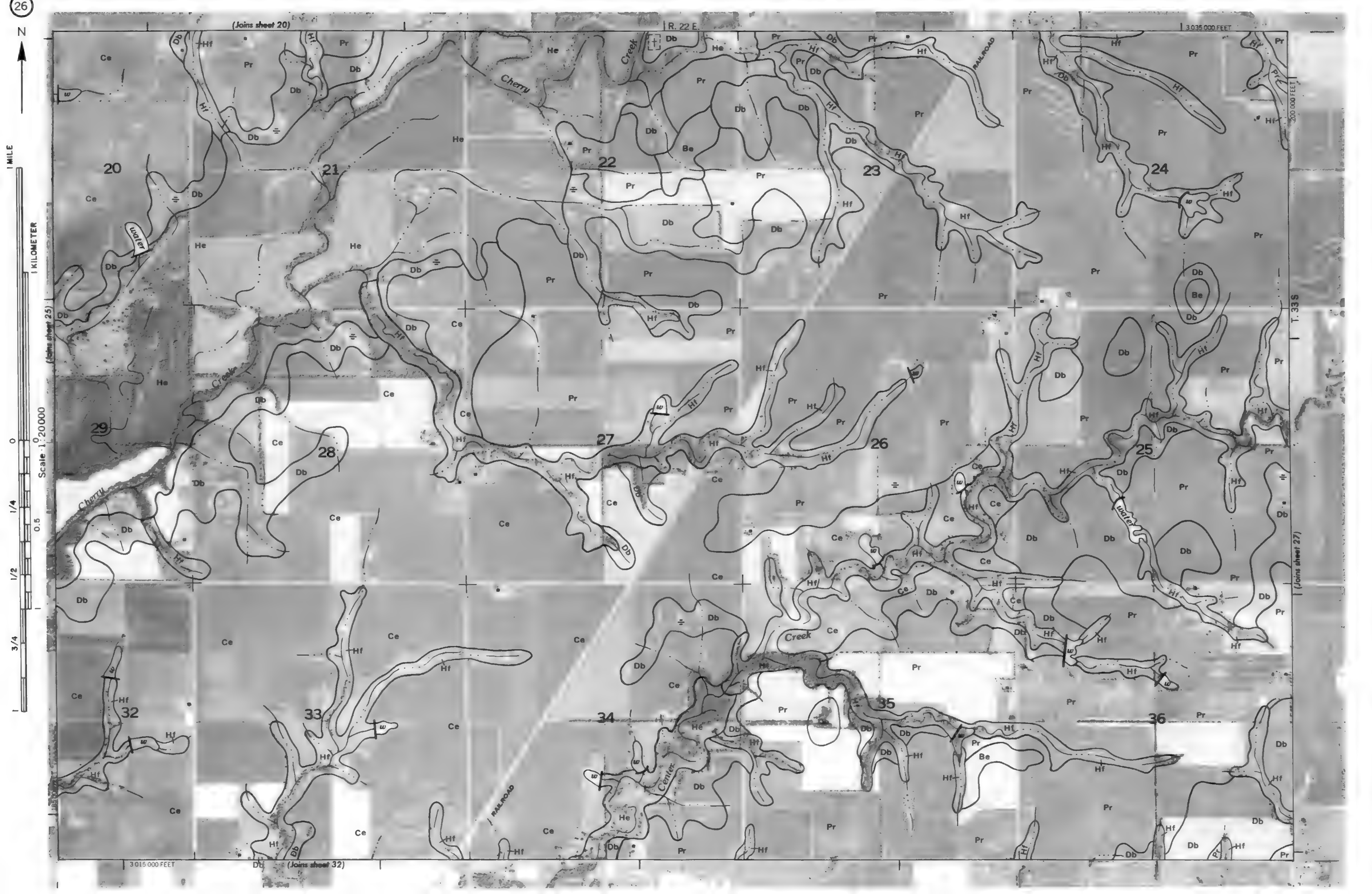
CHEROKEE COUNTY, KANSAS NO. 24

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 25



CHEROKEE COUNTY, KANSAS NO. 25

This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEROKEE COUNTY, KANSAS NO. 26

CHEROKEE COUNTY, KANSAS NO. 27

This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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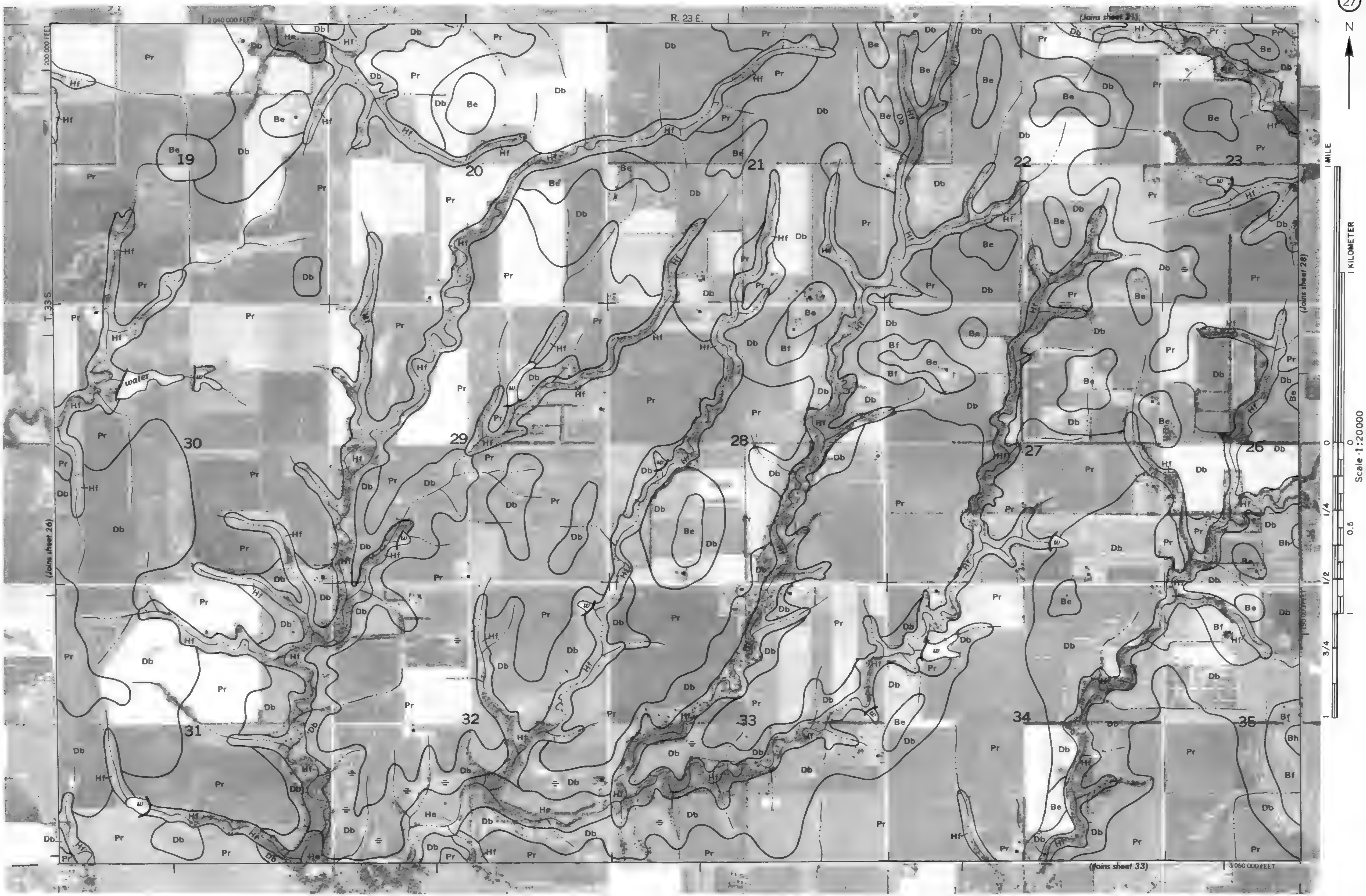
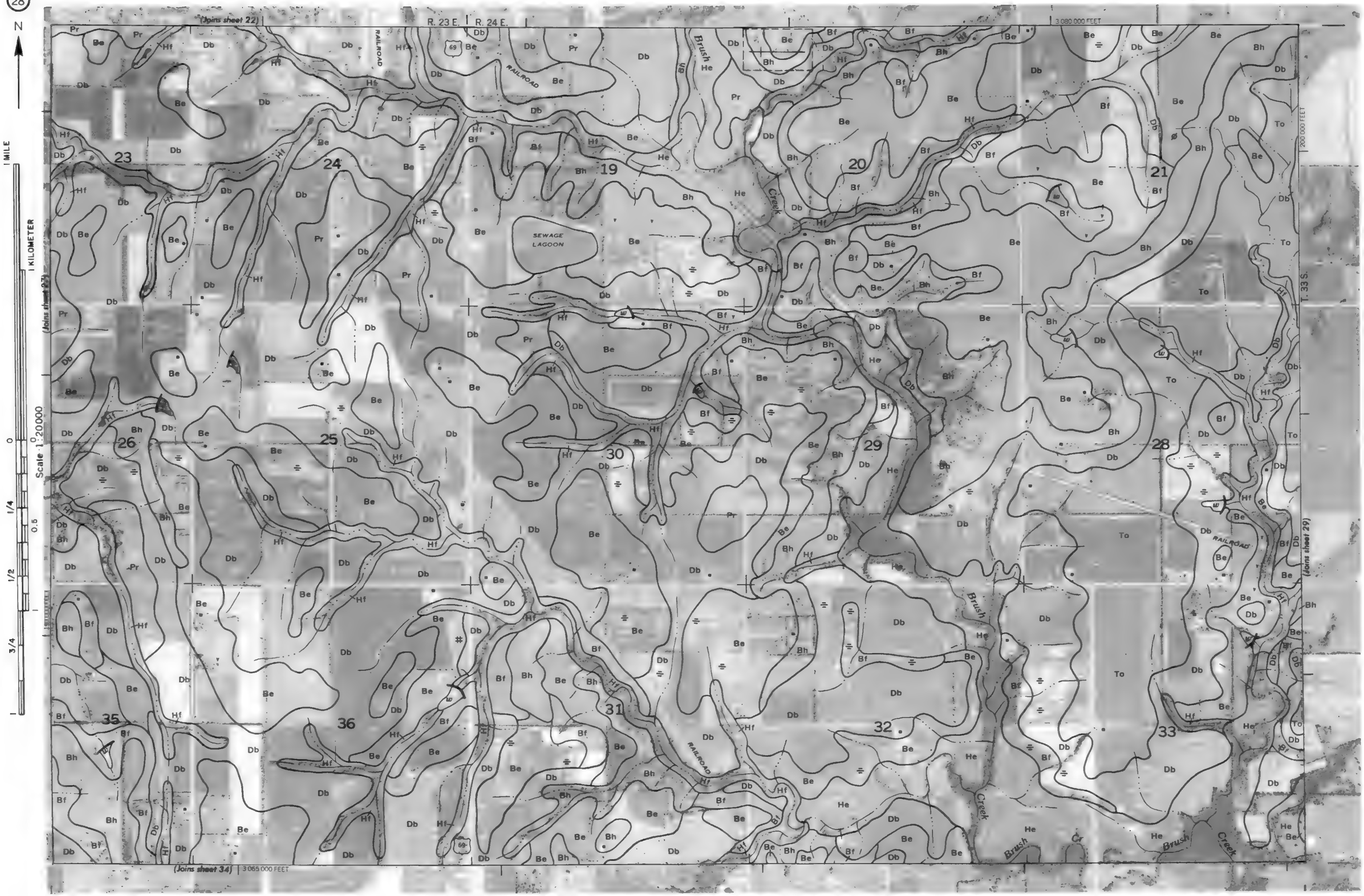


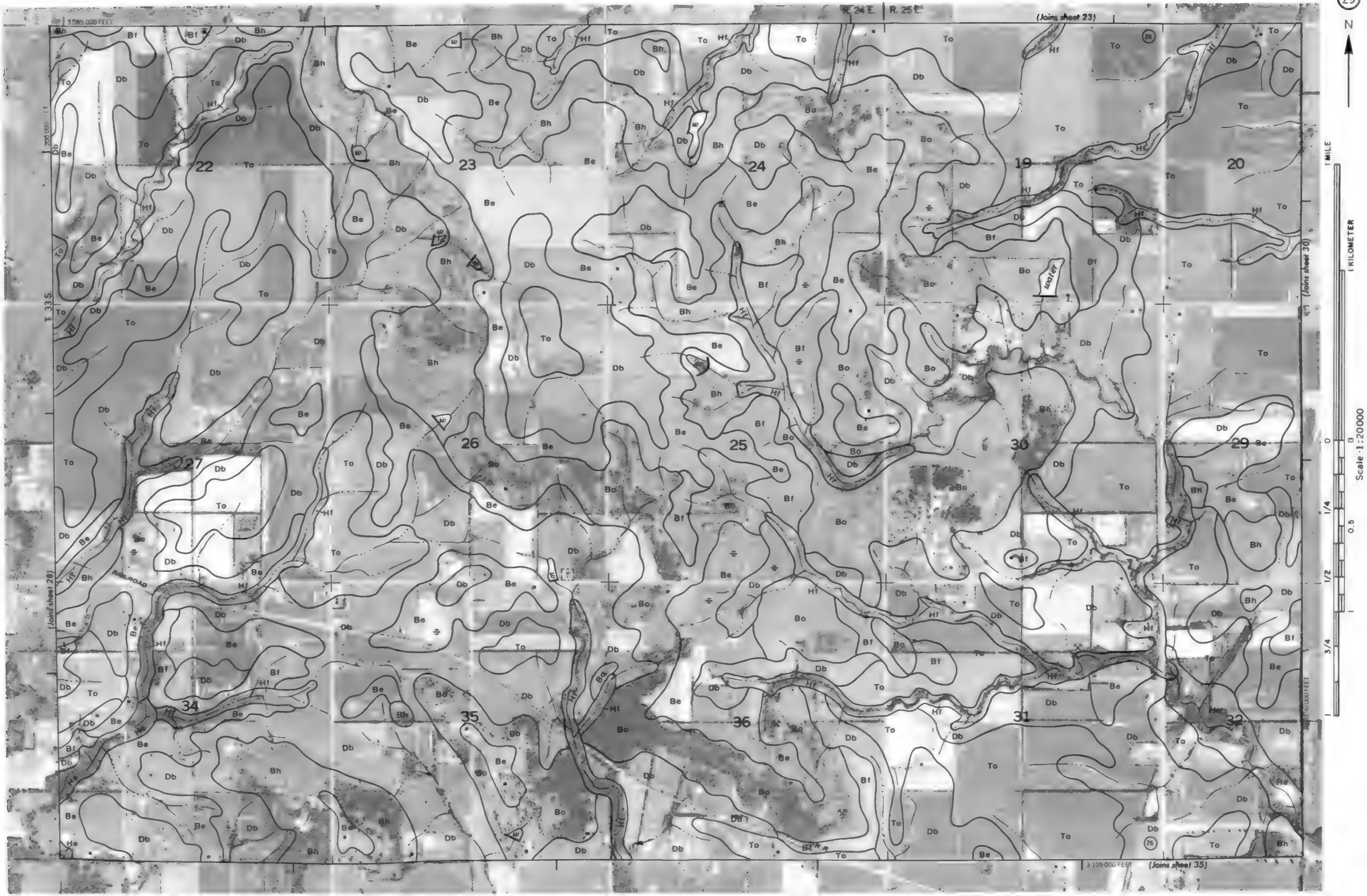
SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 28



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

CHEROKEE COUNTY, KANSAS NO. 28

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 29



CHEROKEE COUNTY, KANSAS NO. 29

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 30

This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEROKEE COUNTY, KANSAS NO. 30

CHEROKEE COUNTY, KANSAS NO. 31

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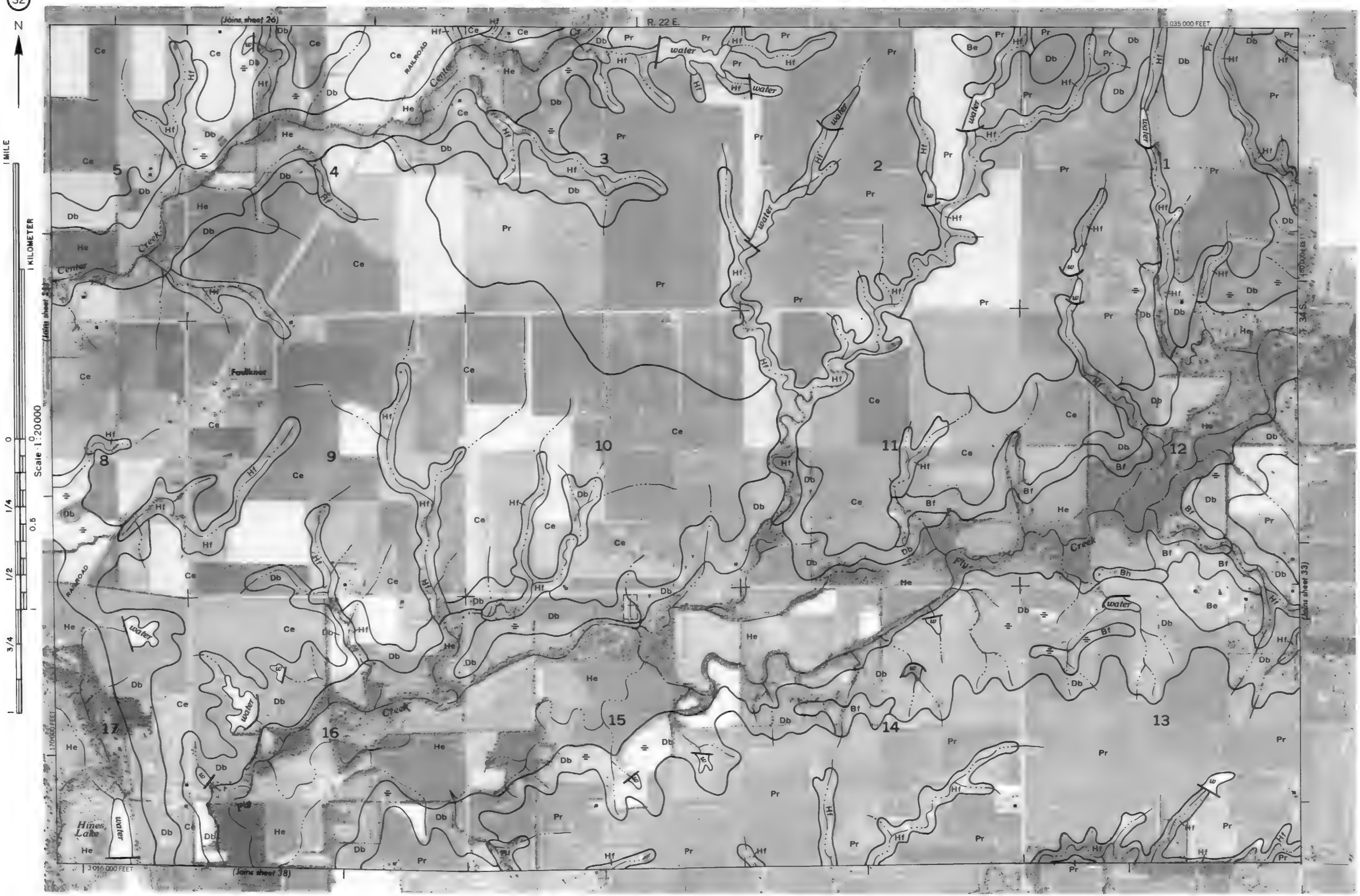
SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 32



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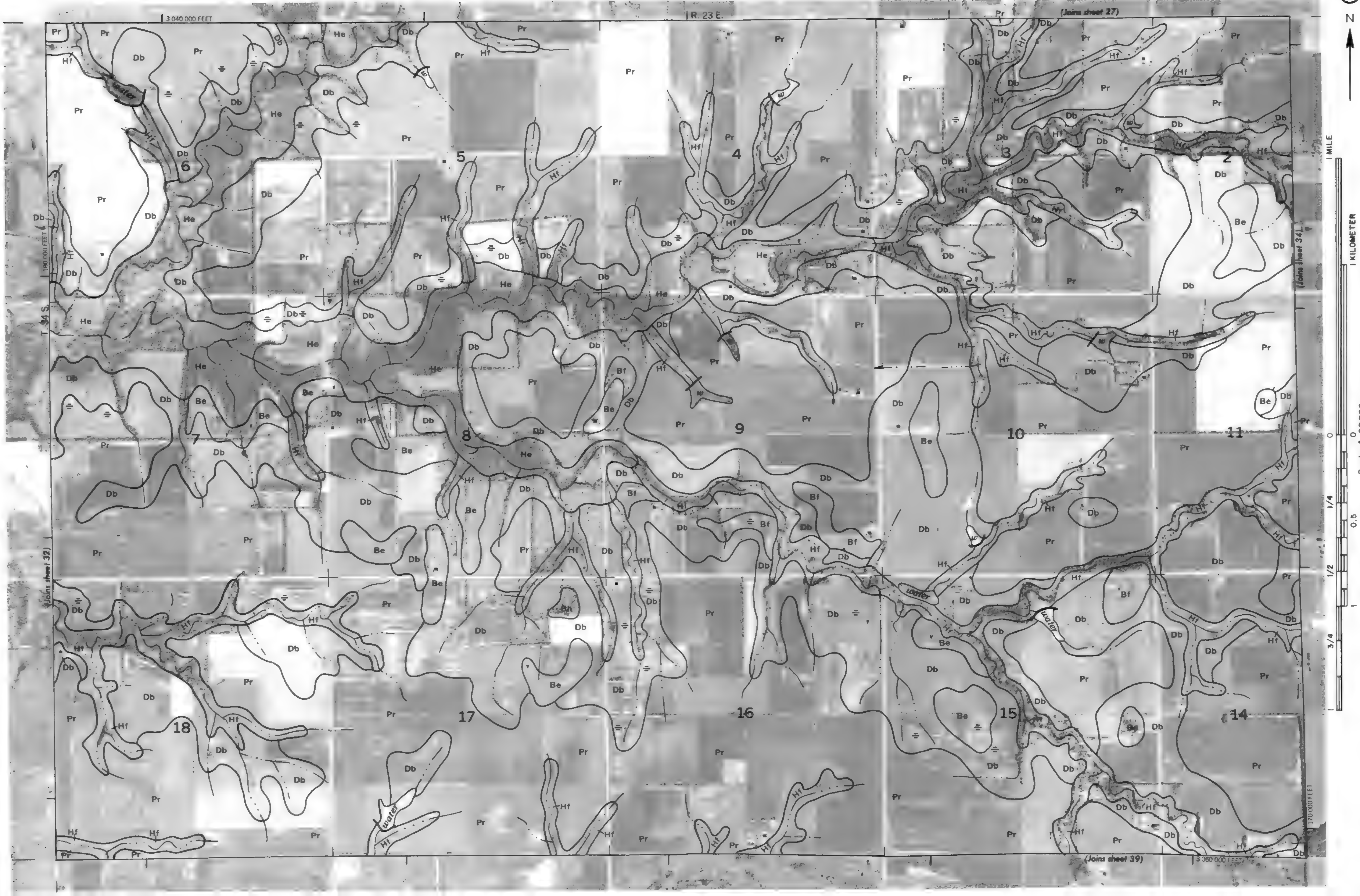
Coordinate grid ticks and land division corners, if shown, are approximately positioned

CHEROKEE COUNTY, KANSAS NO. 32



CHEROKEE COUNTY, KANSAS NO. 33

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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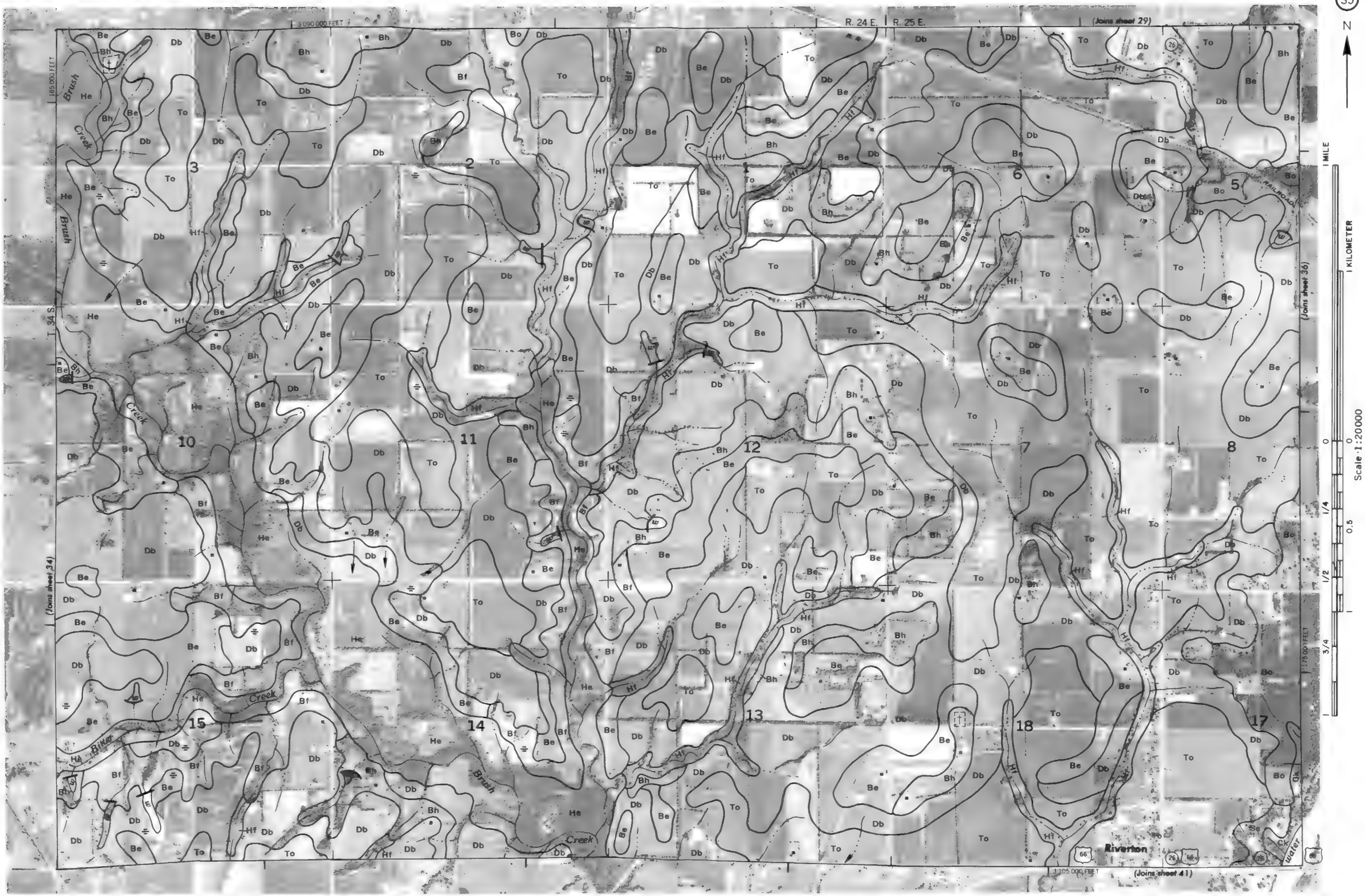
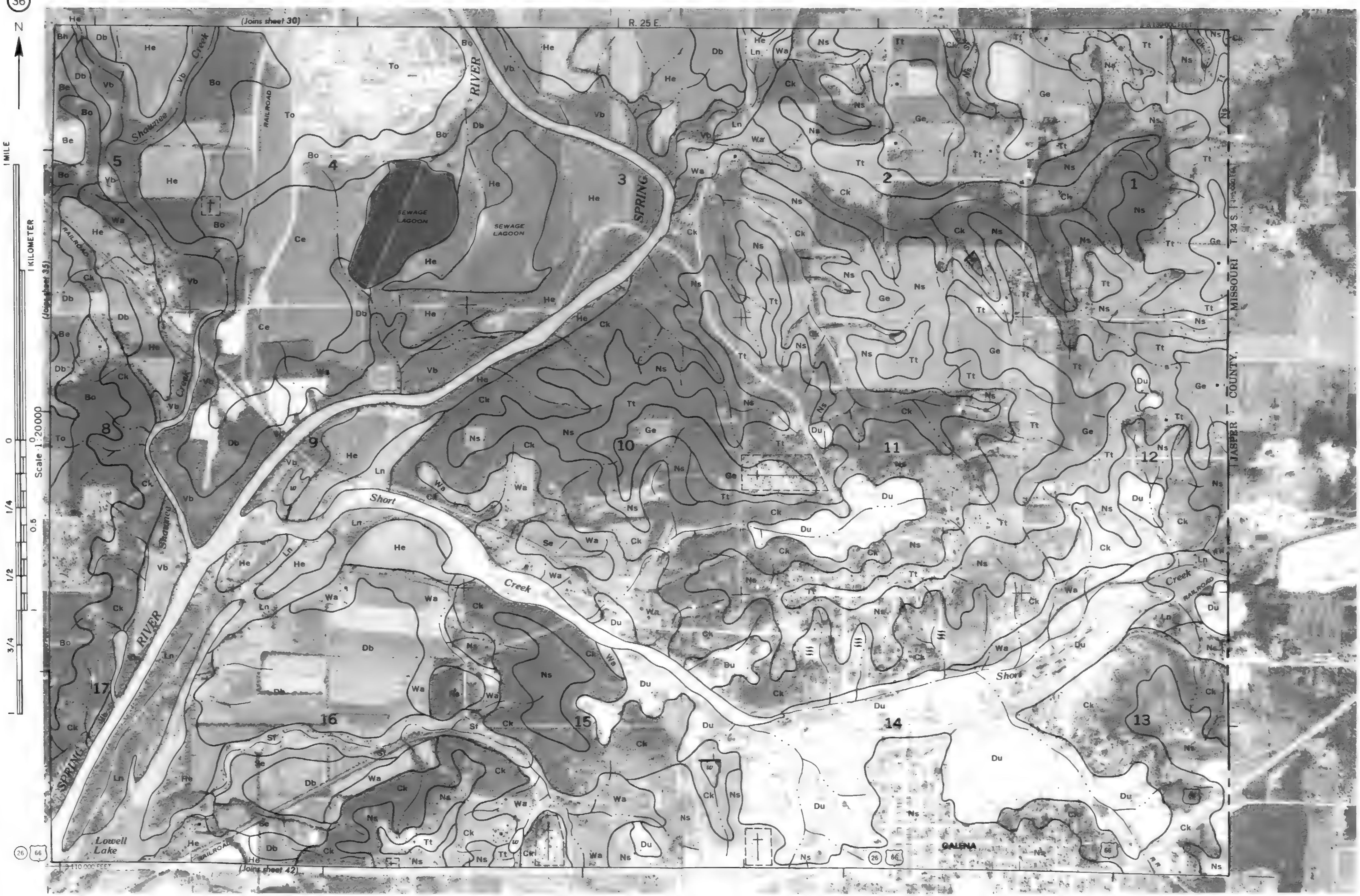


SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 36



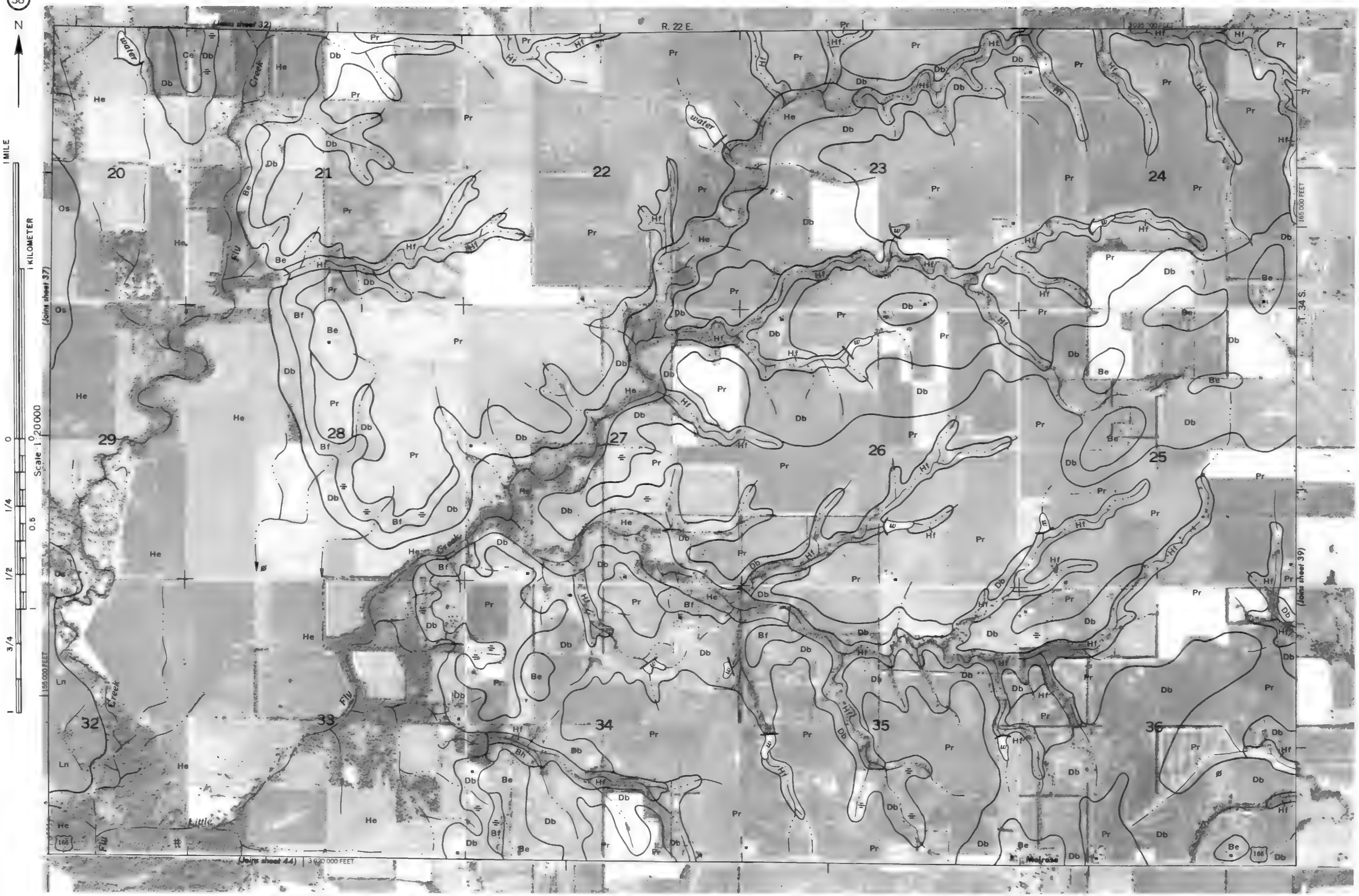
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEROKEE COUNTY, KANSAS NO. 36

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 37

CHEROKEE COUNTY, KANSAS NO. 37

This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

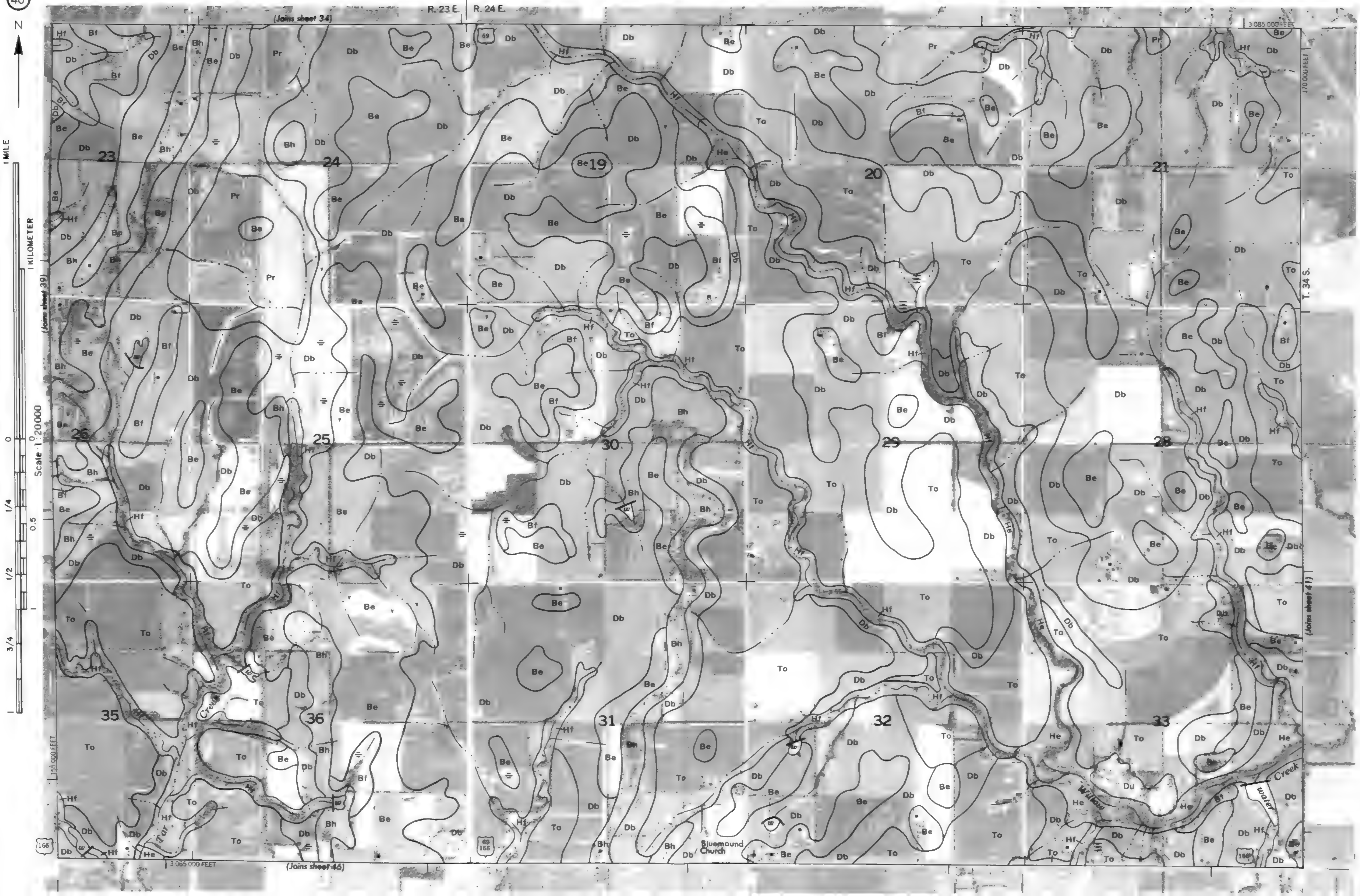


This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEROKEE COUNTY, KANSAS NO. 39

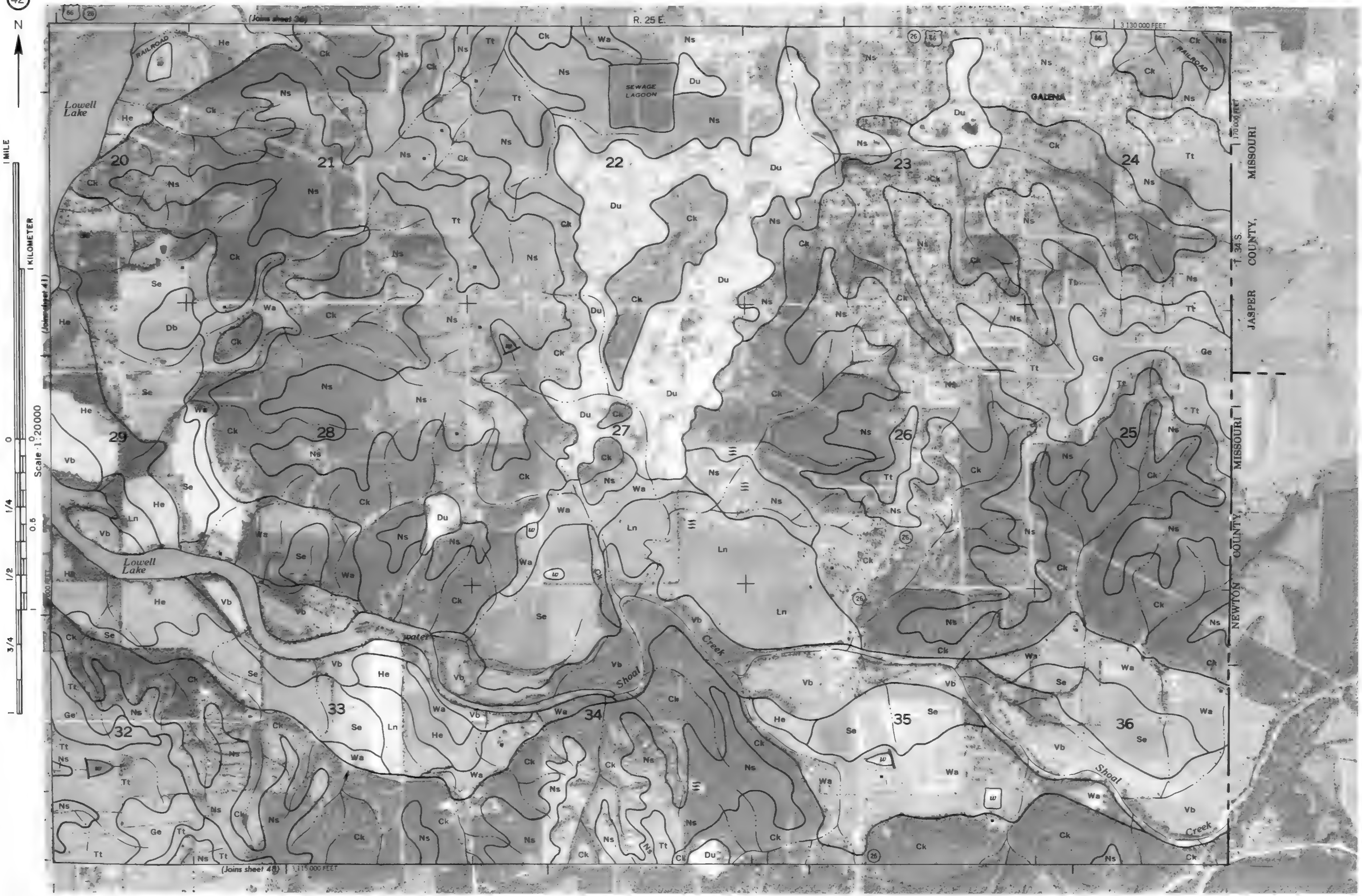
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 40

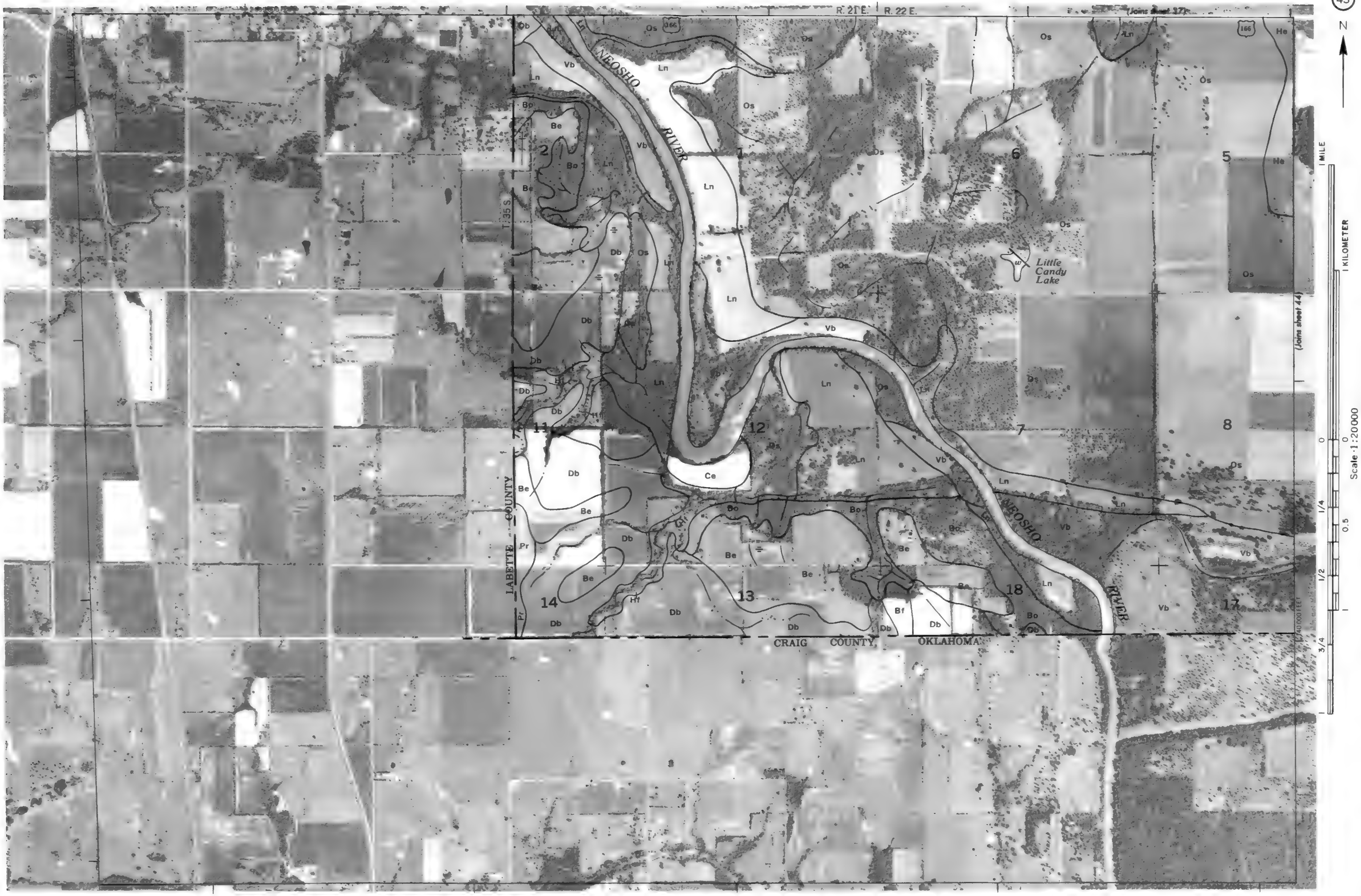


This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


41
N
Riverton
Lowell Lake
SEWAGE LAGOON
RAILROAD
SPRING RIVER
SHOAL CREEK
Willow Creek
Lowell
BAXTER SPRINGS
(Joins sheet 35)
(Joins sheet 40)
(Joins sheet 42)
(Joins sheet 47)
R. 24 E. R. 25 E.
T. 34 S.
3 090 000 FEET
1 MILE
1 KILOMETER
Scale 1:20000



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



CHEROKEE COUNTY, KANSAS NO. 43

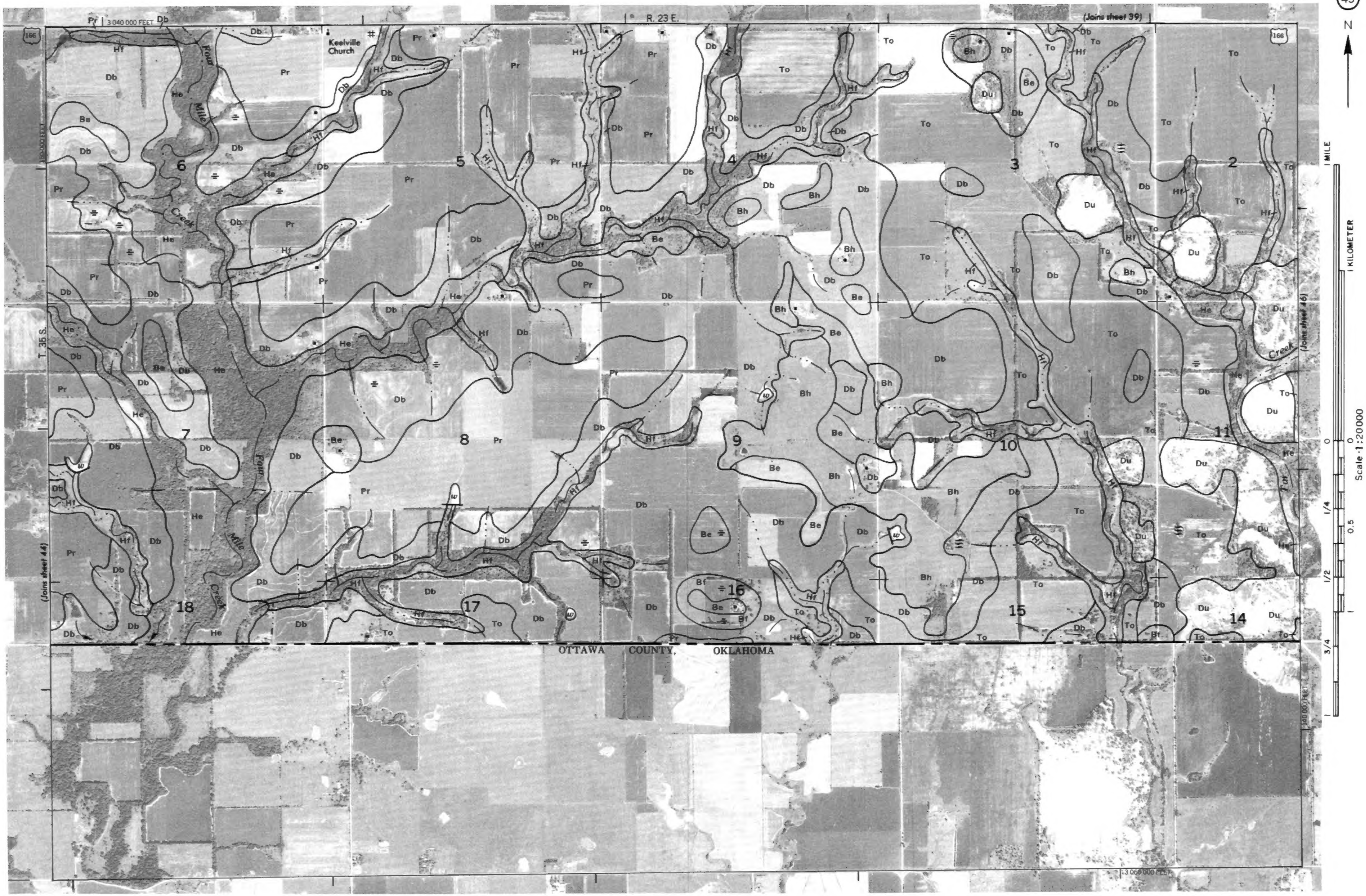
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 44

This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEROKEE COUNTY, KANSAS NO. 44

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 45



CHEROKEE COUNTY, KANSAS NO. 45

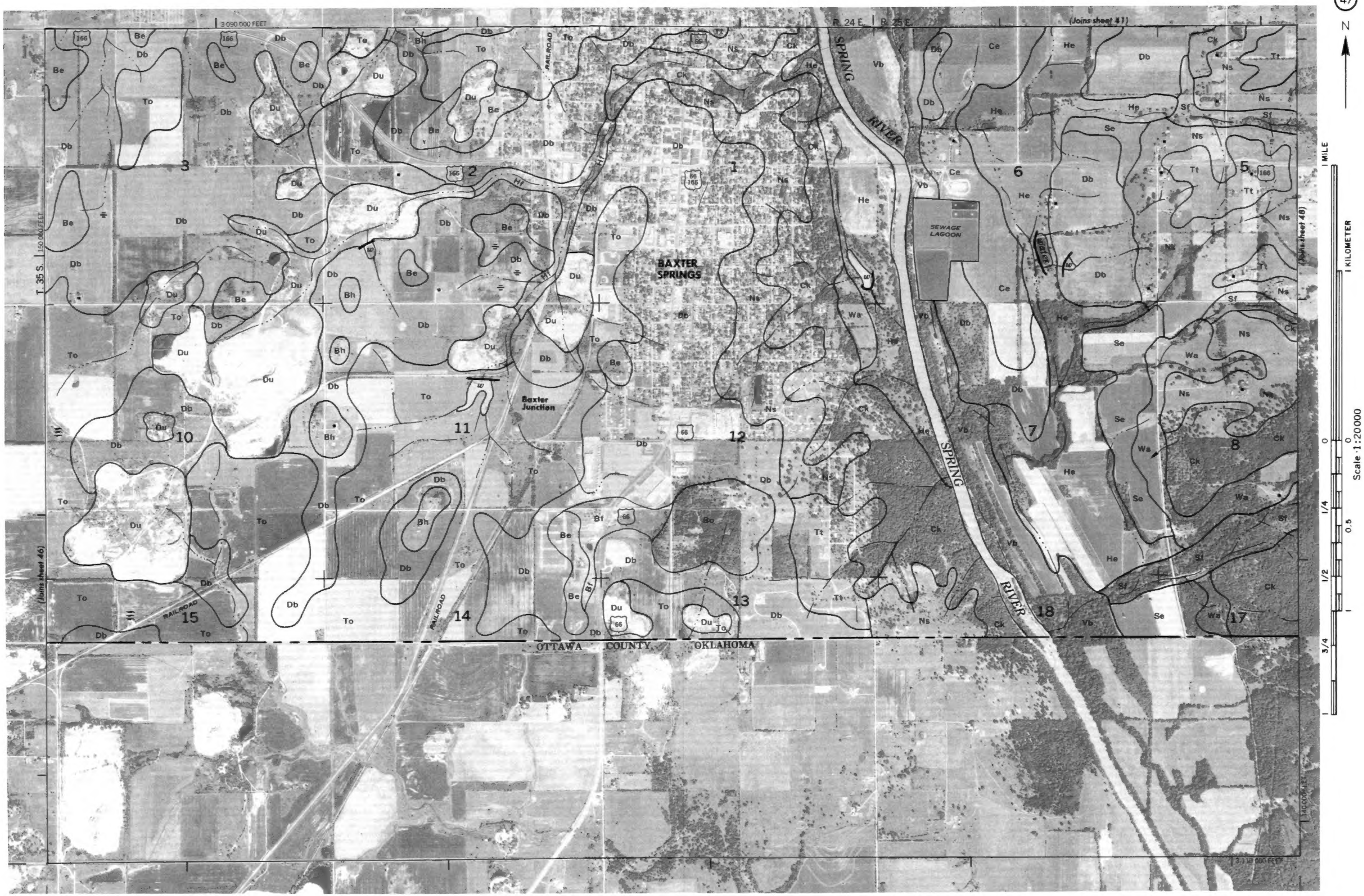
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 46

This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHEROKEE COUNTY, KANSAS NO. 47

This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



SOIL MAP OF CHEROKEE COUNTY, KANSAS — SHEET NUMBER 48

This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.